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I.

NASAL TUBERCULOSIS: TWO CASES, ONE INVOLV-  
ING THE RIGHT ETHMOID BONE, WITH  
RECOVERY AFTER OPERATION.\*

By OTTO T. FREER, M. D.,

CHICAGO.

The account of my own cases is preceded in this paper by a short composite description of nasal tuberculosis obtained from its literature; articles on lupus, because of the proof of its tubercular nature, being also considered. The writings to which I am the most indebted are P. H. Gerber's clear and full description of nasal tuberculosis in *Heymann's Handbuch*, and Kosschier's remarkable series of articles, including many case reports of his own observation, in the *Wiener klinische Wochenschrift* in 1895. In addition to these, two more detailed descriptions, Herzog's paper in the *American Journal of*

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\*Read at the thirty-first annual meeting of the American Laryngological Association, Boston, 1909.

*Medical Sciences* in 1893, Gleitsmann's admirable article on tuberculosis of the accessory sinuses in the *Laryngoscope* for 1907, and a number of other articles mentioned in the literature list have proved of great value.

*Designation.*—Custom still retains the name lupus for the group of cases of nasal tuberculosis possessing special features which were thought to make them a distinct disease called lupus before the identity of tuberculosis and lupus was established. For the sake of a clear understanding of the matter, I have therefore sought out from the literature what are regarded as the distinguishing characteristics of lupus and nasal tuberculosis proper.

Lupus is a form of nasal tuberculosis commonly occurring at the age of puberty, and in women, while ordinary nasal tuberculosis usually occurs between the ages of twenty-five and sixty, and is as frequent in males as in females.

Lupus is a primary form of nasal tuberculosis of an exceedingly slow course, extending at times over decades. It may remain the only evidence of tuberculosis in the body, generally leading late, if at all, to secondary tubercular deposits.

Nasal tuberculosis is more rapid, and less benignant, than lupus, is often secondary to another tubercular focus, especially pulmonary tuberculosis, and, if primary, is disposed to an earlier creation of other tubercular affections than lupus.

Lupus appears in the form of granulations and diffuse infiltrations which, instead of breaking down readily, have a tendency to cicatricial metamorphosis, so that the disease heals by scar formation in some places, while progressing in others. The tubercular tissue in lupus advances superficially in the mucosa and invades cartilage and bone late, if at all, in its course.

In contradistinction to this, the granulation tissue of nasal tuberculosis in most cases breaks down early by cheesy degeneration and produces ulcerations of a more or less destructive character, which are disposed to attack cartilage and bone at an earlier stage than lupus, while cicatrization does not occur.

Granulation tumors, often of considerable size, are occasionally found in nasal tuberculosis, but are not found in lupus.

Lupus, even when at first intranasal, is apt to extend to the skin of the external nose, lips and face. Nasal tuberculosis, on the other hand, commonly stays within the nasal interior.



Histologically the lupus nodule is a miliary tubercle; but usually, instead of disintegrating by cheesy degeneration, disappears by cicatrization, while the tubercle of nasal tuberculosis undergoes the central caseation and destructive softening characteristic of the typical miliary tubercle.

In short, the term lupus may be used to designate the well-known type of mild, slow, cicatrizing tuberculosis which resembles the fibrous type of pulmonary phthisis and which is less apt to destroy the structure it invades than to replace it with connective tissue. In contradistinction to this, ordinary nasal tuberculosis shows the tendency to caseation and breaking down without repair characteristic of the more virulent forms of tuberculosis. The large proportion of cases of the milder lupus form of tuberculosis in the nose indicates a vigorous resistance of its structure to tubercular infection.

So long as the disease remains intranasal it will always be difficult, because of the many cases showing mixed characteristics of both lupus and tuberculosis, to tell to which of the two disease groups a given case should be assigned. But, as the affections are etiologically one, and differ merely in respect to prognosis and pathologic changes, the distinction is not of great importance.

*Etiology.*—The opinion prevails that the usual beginning of both lupus and nasal tuberculosis on the foremost part of the septum is an evidence that the tubercle bacillus finds lodgment in the nose as the result of direct inoculation; for the surface of the cartilaginous septum is especially subject to the impact of particles in the air current, to friction with the handkerchief and to abrasions and eczematous conditions due to this friction, and to picking the nose. In fact, Massei thinks that the establishment of the disease in the usual site at the front of the septum is often caused by direct inoculation of the mucosa with the finger nail contaminated with tubercle bacilli.

Hematogenous conveyance of the bacilli into the nasal tissues is thought possible in rare instances.

While the authorities concede that absolute proof that a tubercular affection is primary is to be supplied only by an autopsy, it is nevertheless agreed that the course of almost all cases of lupus and of many cases of nasal tuberculosis indicates a primary tubercular lesion.

The rarity of tuberculosis of the nasal passages, in spite of

their exposure to inhalation infection, is explained, though but theoretically and without experimental basis, as due to the bactericidal qualities of the nasal mucus, the ejecting action of the cilia of the epithelium and the protective presence of a sub-epithelial adenoid layer of cells.

*Appearances and Symptoms.*—Nasal tuberculosis is divided according to its aspect into four forms: the tubercular ulcer, the tubercular tumor or tuberculoma, the diffuse infiltration and the formation of granulation areas, the latter being the variety characteristic of lupus.

*The Tubercular Ulcer.*—In this group of cases, to which belong most of those secondary to pulmonary or laryngeal phthisis, ulceration is the chief characteristic of the affection. The tubercular infiltration which precedes the ulcer is rarely seen, as it creates no symptoms, the first thing ordinarily discovered being the fully developed ulcer, which makes its presence known by producing obstructing scabs in the affected naris.

When cleansed of these scabs the ulcer, in its early stage, is usually found to be solitary and to be seated upon the anterior part of the cartilaginous septum. Its form is round, oval or irregularly gnawed out and scalloped. Its floor is rarely clean, being usually covered by a yellowish thin false membrane, out of which sprouting, fungous, pale granulations arise. The tissue surrounding the ulceration is seldom congested, may even be pale, and is commonly invaded and thickened by tubercular infiltration of varying extent. The borders of the ulcer may be steep, but are usually shallow, and in almost all instances so ill-defined that it is impossible to tell exactly where, beyond the ulcer, the intact epithelium begins, so much is it fretted by minute ulcerations scattered about the ragged edge of the central ulceration.

While small nodular collections of miliary tubercles studding the mucous membrane about the tubercular ulcer are commonly described as a characteristic aspect, I could see nothing of the sort in my two cases of nasal tuberculosis, nor have I so often met with this condition in the neighborhood of tubercular ulcers of mucous membranes elsewhere that it seems to me at all a usual feature, and I think that its description as typical represents text-book tradition rather than actuality.

While the tubercular ulcer is seldom rapidly destructive and



is usually slow to invade cartilage and bone, still in the course of time it produces perforations of the septum and caries of its skeleton.

In spreading beyond its usual site on the septum the ulceration commonly progresses across the nasal floor to the inferior turbinated bodies.

*The Tubercular Tumor.*—This is usually solitary, and, like the other forms of nasal tuberculosis, often appears upon the cartilaginous septum, and next in frequency upon the inferior turbinated body. It varies in size from the bulk of a pea to growths large enough to be mistaken for sarcoma, as occurred in a case which came to my knowledge. Herrmann Coenen describes a tuberculoma so large that it filled the right nasal fossa, forced over the septum, infiltrated the hard palate and required extensive resection of the bones of the nasal skeleton for its removal. After the operation the patient died of septic pneumonia, the autopsy showing primary nasal tuberculosis. Rucda also reports a large tuberculoma weighing thirty-five grams.

A nasal tuberculoma may be spherical or lobulated, may have a papillomatous, smooth, or irregular surface, and may be pedunculated; but it has usually a broad base. Its color is grayish red, or dark red, or whitish. Characteristic of tubercular tumors are their friability and their tendency to ulcerate.

*The Tubercular Infiltration.*—This variety, like the edematous form of laryngeal phthisis, with its deep-seated tubercular infiltration of the submucosa and perichondrium of the larynx, produces diffuse swelling of the part in the nose attacked, which is usually the cartilaginous septum, the skeleton of this structure as well as the mucosa being invaded by the tubercular granulations. Entering thus deeply into the framework of the septum, the disease expands it in the form of diffuse, pale pink, resistant swellings whose surface may show sprouting granulations or ulceration in some places, while remaining smooth in others. In marked cases the thickened septum may appear like a tumor filling both nares and feel like a hard lump when the external nose is grasped. Later carious breaking down of the infiltration often leads to multiple perforations of the septum and extensive destruction of its skeleton. The disease is apt to advance into the external nose from underneath, causing it to thicken and broaden.

The tubercular infiltration in its more superficial and less destructive forms approaches lupus in character. When actively progressing it is the most formidable variety of nasal tuberculosis.

*Proliferation of Granulations.*—The form of intranasal tuberculosis typical of lupus is the granulating area upon the mucous membrane. It commonly begins, as do the other varieties, upon the cartilaginous septum and appears as a bed of grayish red granulations, producing a surface like that of a raspberry, generally hidden by scabs. Later in the disease the granulations also appear upon the lower turbinated bodies.

This is the most benignant of the varieties of nasal tuberculosis. While it may lead to perforations of the cartilaginous septum, it is not its nature to enter deeply into the structures it occupies, and it progresses superficially over increasing areas of the mucosa and commonly later also over the skin of the external nose. Its tendency to form cicatrices may narrow the external nostrils.

In addition to the typical forms described, Koschier mentions a case of nasal tuberculosis having an exceptional primary deep beginning in the bones of the septum and inferior turbinated bodies invading the mucous membrane from beneath.

The symptoms caused by nasal tuberculosis are mainly scabbing, due to drying of the scanty secretion from ulcerated and granulating surfaces, and nasal obstruction.

*Pathologic Histology.*—Microscopic sections of the tissue attacked and of the tumor formations show a diffuse infiltration of lymphoid and epithelioid cells traversed by connective tissue bands, with often so great a scarcity of typical miliary tubercles and isolated giant cells that many sections may need to be examined before these objects are discovered. Tubercle bacilli are generally rare, are most frequent in the deeper parts of the products of the disease, and are often not to be discovered in tissue typically tubercular.

*Diagnosis.*—While the most important means of establishing the diagnosis is a histologic examination of excised tissue, the microscopic findings may nevertheless be doubtful, because of the rarity of elements distinctly tubercular in the specimen examined. Typical miliary tubercles with a center of cheesy degeneration and giant cells may be regarded as pathognomonic, even if bacilli be not found, but, as shown by Max



Goerke, giant cells alone do not prove the existence of tuberculosis, as they are also found in the products of tertiary syphilis and as the result of the entrance of minute foreign bodies into the tissues. Both of these conditions may, however, usually be excluded clinically, and the history of the case, its gross appearances, and the finding of giant cells in fields of epithelioid and lymphoid cells, establish the diagnosis with sufficient certainty, even though typical tubercles and bacilli be not found in the sections.

The inoculation of suspected tissue into animals remains equivocal, even if they become tubercular, as it is impossible to exclude contamination of the specimen employed with tubercle bacilli accidentally present in the nares.

The mere gross appearances may be deceptive, as I found in the case of a young man with extensive and obstinate ulcerations and large areas of granulations on the septum and inferior turbinated body, the aspect of the affection being so much like tubercular ulceration that I was surprised when repeated microscopic examinations showed an almost pure culture of influenza bacilli in the false membrane removed from the surface of the ulcers and simple inflammatory ulceration in the tissue examined microscopically. In spite of the comparatively innocent infection in this case, mild measures were of no avail, and excision of the diseased mucosa on the septum and resection of the lower turbinate were necessary to effect a cure.

Syphilitic ulceration and hyperplasia are usually attended with extensive necrosis of bone, the formation of large sequestra and putrid discharge. In contradistinction to this, where destruction of bone and cartilage occurs in nasal tuberculosis it is by insensible softening and carious absorption by the advancing granulation tissue without fetor or the formation of a sequestrum.

*Prognosis.*—Nasal tuberculosis is commonly a benignant and often primary form of tuberculosis in a tissue little susceptible to the disease and permitting but few bacilli to penetrate it. If, therefore, the tissue invaded can be completely removed, recovery without a relapse is a possibility. Even in lupus, and still more in common nasal tuberculosis, secondary deposits in the form of pulmonary tuberculosis, tubercular meningitis, tubercular lymphomata, joint disease or some other form of tuberculosis are to be feared so long as the primary affection in the nose is not extirpated.

*Treatment.*—The structures forming the nasal cavity are not of vital, or the highest, functional importance, and are comparatively accessible, and for this reason, as compared to its location in other organs, primary tubercular disease within the nose is somewhat favorably situated for the thorough surgical extirpation which its dangerous and obstinate nature demands as the treatment of choice, in case it be deemed feasible. As compared to surgical excision all of the other methods of treating nasal tuberculosis are far less certain in their results, some being but vaguely experimental, and they are justifiable only where the extensions of the disease have gone so far that its surgical removal involves great disfigurement, such as the sacrifice of the external nose, or where these extensions have entered regions whence they cannot be removed by operation with the preservation of life.

The best implements for the excision of the tubercular products are those which cut them out as cleanly as possible: rounded knife blades, chisel-shaped blades, the punch forceps and, merely as an adjuvant, the sharp spoon. The latter implement is often described as being the main reliance for the removal of the tubercular tissue. Its action is, however, too circumscribed and inaccurate. It leaves torn shreds of flesh behind, and cannot cut away the apparently healthy, but suspicious, zone about the tubercular granulations or ulcer which it is absolutely necessary to remove in order to diminish the likelihood of recurrence. Even a careful excision will, of course, not insure against a reappearance of the disease somewhere in the nose; for the least remnant of tubercular tissue left will reproduce the disease, and in such instances, as in my first case, the tubercular granulations must be followed by secondary operations until they no longer return.

The measures which may be employed where the disease is beyond operation, as in my second case, are the excision of obstructing masses of tubercular tissue as far as possible, curettement followed by lactic acid, tuberculin, Holländer's destruction of tubercular tissue by superheated air, the galvano-cautery and the X-ray. Massei states that electrolysis has not become popular, and that long trials of phototherapy have proved ineffective.

As mentioned by Massei, extensive operations on the bony skeleton of the facial nose, opening it widely, are often need-



lessly employed to make intranasal tuberculosis accessible for curettement or for its removal in other ways, where an operation through the nostrils would have given ample access.

My first patient was a young woman of twenty; first seen on September 5th, 1907. Her chief symptom was an odorless, mucopurulent discharge, tending to dry into scabs, and coming from the right nostril, which had been constantly more or less obstructed since the condition began, in March, 1906.

Inspection showed the left naris to be normal. In the right an elevated, cockscomb-like ledge of pale pink granulations could be seen upon the septum, beginning in front opposite the anterior end of the middle turbinated body and following the septum clear to its posterior border, where it could be seen by posterior rhinoscopy, projecting into the nasopharynx as an irregular, superficially ulcerated, whitish tumor, of the size of a hazel-nut. (Fig. 1.) Back of its posterior third the middle turbinated body was involved in the disease, the granulations bridging and filling the space between it and the septum, as could be seen by both anterior and posterior rhinoscopy.

On September 27th, 1907, the diseased outgrowth was removed from the posterior border of the septum by an angular blade which hooked behind it and cut up and down, while a probe in the left nostril pushed the mass over into the right to steady it. The granulating area on the right side of the septum was then dissected off to the cartilage and bone by means of one of my sharp elevators used in the submucous resection. This procedure radically extirpated the tubercular tissue from the septum, and no recurrence ever took place on this structure.

The middle turbinated body was then resected along its whole length with one of my septum knives, its tissue cutting readily, owing to carious absorption of the bone by the tubercular granulations. The stump was then trimmed with the Grünwald-Hartmann punch forceps until all the disease seemed removed.

Microscopic examination of the tissue showed abundant giant cells embedded in fields of epithelioid cells; but no tubercles or bacilli were found at this time.

The denuded area healed promptly, but scabbing began again after some weeks in the region of the stump of the middle turbinated body, from which pale polypoid granulations were seen to be again sprouting. On November 25th, there-

fore, all but a posterior remnant of the stump of the middle turbinated body was extirpated with what tissue seemed to be tubercular. Again the disease seemed eradicated, until, in January, scabbing recommenced, and fungous granulations could be seen growing along the attachment of the extirpated middle turbinated body, showing involvement of the ethmoid labyrinth underneath it. Therefore as complete an intranasal extirpation as possible of the right ethmoidal cells was performed on January 31, 1908.

The first operations, done with cocain anesthesia, had been rendered hasty, because of the patient's unusual nervousness, which terminated in hysterical attacks. This time, therefore, chloroform was employed, the patient being kept in half narcosis in a half reclining position on a high operating chair, the operator standing at his work. The distinguished Danish rhinologist, Dr. N. Rh. Blegvad, of Copenhagen, who was visiting America upon this occasion, honored me with his assistance. The intranasal excision of the right lateral mass of the ethmoid bone was done in the following manner: A chisel-like instrument with a thin blade bent on the flat at an obtuse angle (Fig. 3), was pushed with the hand upward underneath the nasal bones and nasal spine of the frontal bone and backward under the cribriform plate (Fig. 2), in order to sever the anterior and upper surfaces of the lateral mass of ethmoid cells from their attachment to the cribriform plate and ethmoidal notch of the frontal bone as far outward as the os planum (lamina papyracea), the chisel following the direction of the upper and anterior attachments of the perpendicular ethmoidal plate. The mass of cells, thus cleanly detached in front and above, was then removed with the Grünwald-Hartmann punch forceps and Grünwald's set of nasal curettes. A diseased remnant of the middle turbinate was also found and cut away. The operation left a large hollow space extending outward from the septum to the os planum. No reaction followed, beyond slight pain in the right orbit when the eye was moved, and in the course of about two months the whole cavity left by the excision of the ethmoidal cells had healed over smoothly. No trace of tubercular disease had reappeared either on the septum or in the region of the extirpated ethmoidal cells at the last examination, January 18th, 1909.

Examination of sections of the removed ethmoidal lateral



mass showed the typical miliary tubercle shown in the drawing (Fig. 4) and some tubercle bacilli, thus making the diagnosis absolute.

The patient was nervous for some months after the operation, and had marked asthenopia, being unable to read or sew without exciting pain in the eyes, especially in the right eye. These symptoms have disappeared, and she is now in full health.

My second patient was typical of a grave variety of infiltrative nasal tuberculosis. She was a woman of fifty. No tuberculosis in the family and no luetic history. Her nasal affection began in June, 1908, the chief symptom being obstruction in both nostrils, which had gradually increased, until three weeks had gone by before she was first seen, on September 7th, 1908. In September she first noticed swelling of the external nose on either side of the bridge. There was no scabbing, and only a slight, watery discharge from the right nostril. No pulmonary involvement.

Examination showed a bulging swelling on either side of the nasal bridge, above the wings of the nose, as in the sketch. (Fig. 5.) This bulging was due to a great broadening of the foremost part of the cartilaginous septum where it blends with the triangular cartilages of the external nose, this broadening lifting the sides of the nose outward.

Rhinoscopy showed complete obstruction of both nares by the thickened septum, the thickening extending into the perpendicular plate above. The surface of the diseased septum on both sides was knobbed into irregular swellings and showed intact epithelium in some places, while in others it was covered with beds of pale pink, fungous granulations upon which ill-defined, superficial ulceration of a cheesy color could be seen. (Fig. 6.) The ulceration also extended across to both lower turbinated bodies, and the granulations had created adhesions between the left lower turbinate and septum. A contact ulcer also existed on the inner surface of the external nose on the left side, in the region of the limen nasi.

Sections from a piece excised from an ulcerated area on the right side of the septum were examined microscopically by Dr. Maximilian Herzog, who declared the tissue to be tubercular with a hypertrophic tendency and few infecting bacilli. The microscopic field showed epithelioid cells, lymphoid cells, polynuclear and giant cells.

Because of the extensive involvement of the triangular cartilages of the external nose from beneath, the tubercular infiltration of the thickness of the entire cartilaginous septum, and the widespread areas of tubercular granulations in the nasal fossae, it was obviously impossible to radically excise the diseased tissue, and therefore only the obstructing hypertrophic masses were cut away on both sides of the septum, in order to permit of free breathing. The nose remained open for two months, and during this period Dr. Herzog employed tuberculin injections, but without perceptible benefit. After this period the patient failed to return, so that there is no further history.

The complete recovery in the first of my two cases indicates the primary nature of her nasal tuberculosis and shows the value of surgical excision of the diseased tissue, provided it can all be removed. The possibility of a practically complete intranasal extirpation of the ethmoid cells on one side is also demonstrated. Had the disease had time to deeply invade the infundibular region and the frontonasal duct or frontoethmoidal cells (infundibular cells of Heymann) surrounding it, a later external operation through the processus frontalis of the superior maxillary bone might have been needed to clear this difficult region.

My second case is of interest as showing typically the deep-seated, formidable, infiltrative variety of nasal tuberculosis which permeates the cartilaginous skeleton of the nasal septum and of the external nose from beneath, and is similar to other cases of the kind described in the literature.

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FIGURE 1.

Case 1. View by posterior rhinoscopy of tubercular granulation tumor projecting from posterior border of vomer and uniting the vomer to the middle turbinated body.

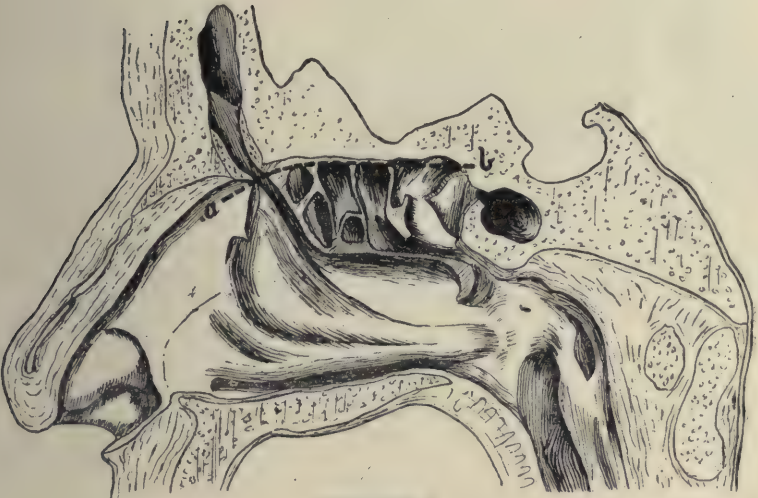


FIGURE 2.

Case 1. View of lateral wall of right nasal fossa. The middle turbinated body has been excised and the ethmoidal cells uncovered by removal of the inner vertical plate of the right lateral mass of the ethmoid bone. The dotted line a.....b indicates the path of the ethmoidal chisel in cutting through the attachment of the ethmoidal cells above.



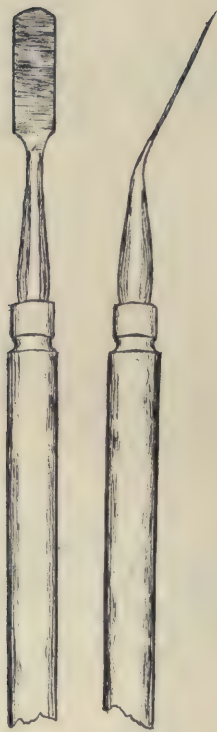


FIGURE 3.

Thin-bladed ethmoidal chisel, bent on the flat. Natural size.

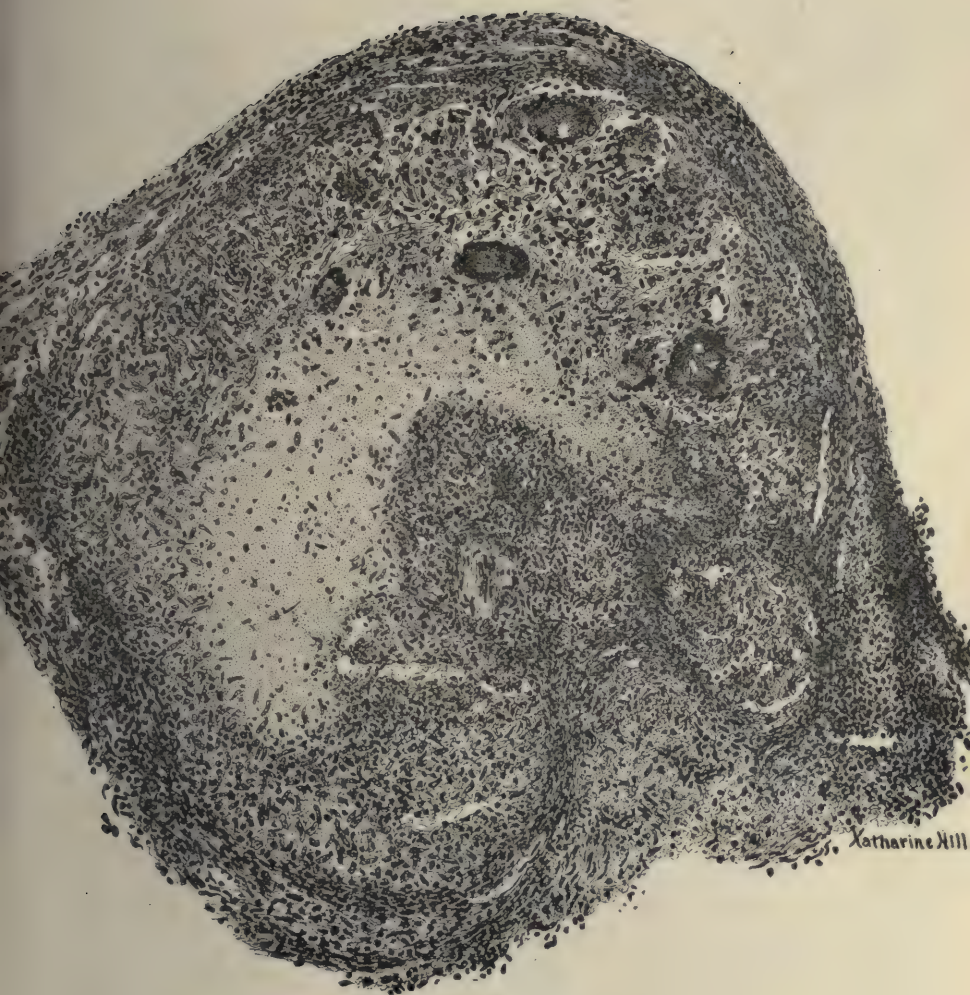


FIGURE 4.

Case 1. Tubercle from ethmoid region showing caseation of center and giant cells.



FIGURE 5.

Case 2. Swelling of bridge of external nose due to tuberculosis of the cartilaginous septum and lateral cartilages of the external nose.



FIGURE 6.

Case 2. View into the right naris showing granulating tubercular ulceration of the cartilaginous septum and right lower turbinated body.



## II.

### EXTENSION AND FLEXION IN DIRECT LARYNGOSCOPY: A COMPARATIVE STUDY.\*

BY RICHARD H. JOHNSTON, M. D.,

BALTIMORE.

The development of direct laryngoscopy has opened up a new era in the treatment of laryngeal disease. Lesions, especially in children, impossible to diagnose and to reach with the mirror, can now be handled with comparative ease. To Killian in Europe and to Jackson in this country we owe a debt of gratitude for placing the method on a rational basis. Improvements in instruments and technic have placed direct laryngoscopy within the reach of every laryngologist. When one becomes expert with the tube, he approaches all laryngeal lesions with greater confidence. It is only a question of time when it will replace the mirror for nearly all operative work in the larynx.

There are two methods of direct laryngoscopy: the one in which the head is held back in extension, and the other in which the opposite or flexed position is used. The former method has been used a long time; the latter, so far as I know, was first suggested by Dr. H. P. Mosher, of Boston, and has greatly simplified the examination of the larynx and the upper end of the esophagus in selected cases. We are all familiar with the extended position as practiced by Killian and Jackson, the latter of whom has given us an instrument which is very useful in both the sitting and prone extended positions. Before referring to the comparative merits of extension and flexion, it may not be out of place to describe briefly the method of extension which has proven most satisfactory to me.

A half hour before the examination, the patient is given a hypodermic injection of morphin ( $1/4$  grain) and atropin

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\*Read before the American Academy of Ophthalmology and Otolaryngology, at the fourteenth annual meeting, held in New York City, Oct. 4, 5 and 6, 1909.

(1/150 grain), to relax the muscular system and to dry up secretion. He is seated upon a low stool and the pharynx and larynx are anesthetized, with a 20% cocain solution, by means of curved forceps. After waiting a few minutes the head is extended and supported by an assistant and Jackson's separable speculum, with or without the slide, according as the patient has or has not good teeth, is introduced until the epiglottis comes into view. It is now necessary to use more cocain in the larynx with the special cotton carriers. As one becomes more experienced little cocain is required for examining purposes. The epiglottis and base of the tongue are pulled forward and the posterior wall of the larynx comes into view. If at this point the head be brought forward to a position midway between complete extension and the normal erect posture, the best view of the larynx is obtained. During the past year I have operated in a number of larynges in the semiextended position, the cases including singer's nodes, tumors of the vocal cords, subglottic tumors and thickenings of the posterior wall. If the neck is short and thick and the teeth large, examination in the extended position may tax the patience of the operator to the utmost. In some such cases it is well-nigh impossible to see the anterior part of the larynx. Under general anesthesia, in the prone position, the same difficulties are encountered; in holding up the base of the tongue, the strain on the arm of the operator is so great that it cannot long be maintained. In my earlier work under general anesthesia, I was much discouraged with the direct laryngoscope in diagnosis and treatment; it was possible to see the posterior part of the larynx, but the anterior part of the organ always escaped me.

In April, 1908, Mosher published his "left, lateral route," which, briefly described, is as follows: The patient is etherized, the chin is slightly flexed on the chest, the left cheek is turned to the left until it almost touches the table; the operator sits comfortably at the left of the table and introduces the special spatula with the left hand. When the epiglottis comes into view, it and the base of the tongue are pulled upward by pressing the body of the instrument against the left, upper, bicuspid teeth. A good view of the larynx is obtained; if the anterior part is not seen, an assistant pushes the thyroid cartilage backward. Mosher claims that in 50% of cases the method is successful. It has been my privilege to operate successfully in

one case with his special spatula. The objections to his instrument are that it must be used with a head-light, which, in my opinion, is a disadvantage; it can be used only under general anesthesia; it is cumbersome.\* For these reasons it is doubtful if it will meet with popular favor.

During the summer of 1908 it was my fortune to have under treatment a case of papillomata of the larynx in a child 4 years old. The diagnosis had formerly been made in the extended position, with the patient asleep; attempts to remove the growths *in extenso* proved very difficult. I tried in vain to use Mosher's instrument in the left lateral position; the spatula was so large I succeeded in causing trauma, but could not get a view of the larynx. A pillow was then placed under the patient's head to flex it on the chest, the mouth was opened and Jackson's child speculum with the drainage tube attachment introduced until the epiglottis came into view; this organ with the base of the tongue was easily pulled up, and a perfect view of the larynx obtained. The papillomata were quickly cleaned out with Pfau's cutting forceps. I at once decided to try this method without anesthesia at the first opportunity, realizing that if it could be done successfully the value of the method would be greatly increased.

My next patient happened to be a strong, healthy girl, 6 years old, with dyspnea. She was placed on the table, the head flexed on the chest, her legs, arms and head securely held by assistants, the speculum introduced and a clear view of the larynx obtained so that the diagnosis of stenosis was promptly made. Immediately after the examination the child jumped from the table and, barring a slight increase in dyspnea, was unhurt.

It can be imagined that, since the success of the straight, flexed method, I have discarded extension in children. Instead of Jackson's old speculum with the drainage attachment, I now use the modified child separable speculum. The modification consists in having the vertical part of the handle of the separable speculum cut off and a screw arranged in it so that it can be attached or detached at will. When the vertical handle is detached, the separable speculum makes an ideal instrument

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\*Since reading the above, Dr. Mosher has written me that he has had all his instruments made smaller, so that this objection no longer holds good.



for the straight, flexed method; with the handle screwed in, the speculum is ready for the extended position or bronchoscopy. I wish it distinctly understood that I claim nothing original for the above method. Mosher seems to have been the first to suggest flexion in direct laryngoscopy, and he deserves great credit for his discovery. The method described above will be found superior to Jackson's instrument in extension or Mosher's instrument in flexion.

The straight, flexed position can be successfully used in adults under general anesthesia; in my opinion nearly all such patients can be examined satisfactorily in the sitting, semi-extended position if the operator will have patience and perseverance. In only two cases have I failed to see the entire larynx at the second or third attempt in the sitting position; in one of these patients a thickening of the posterior wall was removed without the slide, while in the other patient a good view of the larynx was obtained, but the cutting forceps were not tolerated.

My chief purpose in asking your consideration of the two methods of direct laryngoscopy is to emphasize the superiority of the flexed method in children. We all know the difficulties which formerly attended the examination of the child's larynx with the mirror; we were fortunate indeed to catch fleeting glimpses of the pathologic condition. The advent of direct laryngoscopy was hailed with delight as giving us an easy and efficient method of examining the child's larynx. But the tube in extension did not fulfill expectations; the cramped position of the operator, the tense condition of the neck muscles and the difficulty of using the instrument proved great drawbacks. That the method was not entirely satisfactory is proven by the fact that such an expert as Mosher was seeking a simpler method. His left lateral route was a step forward, but the cumbersome instrument places it beyond the reach of most of us. The straight, flexed position, as I have chosen to designate it, will, in my opinion, prove the simplest and most satisfactory of all methods for the majority.

To illustrate the simplicity and usefulness of the straight, flexed method, I wish to cite briefly a few cases.

A girl, 6 years old, was brought to the Presbyterian Hospital with marked dyspnea, all the muscles of the neck and chest being involved in the respiratory act. She was placed on the

table, her legs, arms and head held by assistants, and examined in the flexed position without anesthesia. In a few seconds the larynx was exposed and the cause of the dyspnea seen to be a web of tissue between the vocal cords anteriorly; posteriorly there was a small opening through which the patient was getting some air. We realized at once that it would be possible to intubate with a small tube.

In December, 1908, I was asked to see a Bohemian child, 14 months old, at the Garrett Hospital. She had been intubated for diphtheria three months previously and had had increasing dyspnea for two months. The patient was placed on the table and examination made in the flexed position without anesthesia. The vocal cords moved normally; in the subglottic space anteriorly, a grayish mass was seen and posterior to this a small opening through which the patient breathed. The diagnosis of stenosis following intubation was made and the lesion located.

A girl, 2 years old, was brought to the Presbyterian Hospital with dyspnea. She was examined in the flexed position without anesthesia. In a few seconds the diagnosis of papillomata was made. Several physicians who were present saw the growths clearly through the tube.

A boy, 6 years old, had been hoarse for some time. Examination with the mirror failed. The patient was put on the table and examined in the flexed position without anesthesia. The diagnosis of singer's nodes was promptly made.

The severest arraignment of extension in children is probably that of Bokay, who, in his exhaustive treatise, *Die Lehre von der Intubation*, in the chapter on stenosis following intubation, says that Kirstein's autoscope is of no practical value in diagnosis; that Killian's speculum is not practicable on account of the difficulty in using it. He then pays his respects to the mirror method by quoting Hagenbach, who says: "If one has had a large experience in examining the larynges of children he will occasionally be able to make a positive diagnosis of the condition."

At a meeting of the Baltimore Laryngological Society last winter I described the straight, flexed position of direct laryngoscopy. The other laryngologists present did not understand how one could see around a corner through a straight tube. At different times the method was demonstrated to them, and

they all agreed that it has a useful place in the diagnosis and treatment of laryngeal conditions in children. To those who have tried the extended method in children and feel that it is not all that could be desired, I commend the straight, flexed position for its simplicity and usefulness. We cannot all be as expert in the use of the extended position as Jackson, or in the left lateral position as Mosher, so that something simpler is needed and will have a place in laryngology. If one will master the method described above, he will no longer fear any condition in the child's larynx. My confidence has increased greatly since the flexed position has given me such a safe and simple method of examination.

In conclusion, I would call attention to the following points:

Nearly all adults can be satisfactorily examined and treated in the sitting, semiextended position with cocain anesthesia.

The extended position under general anesthesia is difficult because of the cramped position of the arm and of the operator, and the trouble in seeing the anterior part of the larynx. The straight, flexed position without anesthesia is the simplest method for examining the child's larynx for the majority. For the few adults who will not or cannot be operated upon by other methods, the flexed position under general anesthesia will solve the problem.

919 North Charles Street.



### III.

## HEMOPHILIA, WITH REMARKS ON THE HEMORRHAGIC DIATHESIS—CASE REPORTS.

BY THOMAS HUBBARD, M. D.,

TOLEDO.

*Case I. Hemophiliac; Postoperative Bleeding.*—M. G., a healthy, well nourished boy four years of age. During the previous winters had had several attacks of otitis, and was dull of hearing much of the time. In the fall of 1908 he had a severe cold and otitis media, and it was evident that he was drifting into a chronic catarrhal condition. Operation for removal of the large tonsils and adenoids was performed on the 31st of December, 1908. The tonsils were completely extirpated, by blunt dissection and snare, and adenoids removed by curette and forceps. The bleeding was profuse, but it apparently ceased and the child slept most of the following four or five hours. He then vomited an unusually large amount of dark clotted blood. It was a peculiar feature in this case throughout that it was very difficult to determine when he was bleeding.

It is peculiarly characteristic of this type of hemorrhage that the blood clotting is retarded and thus is formed the long ropelike clot hanging so far down into the esophagus that the fresh blood trickles down without any effort at swallowing. This child bled intermittently several hours before the condition was realized, and by that time he was quite exsanguinated. I located the seat of most active hemorrhage in the left tonsillar fossa, and applied digital compression. There was no evidence of bleeding for about 14 hours. Active persistent hemorrhage from the left tonsil was again detected, and I applied the tonsil compression forceps, using very firm pressure for 7 hours. During this period there was some bleeding from the nasopharynx and nose which I attributed in part to the congestion incident to the firm compression of

the larger veins, as evidenced by edema of the left side of the face. Normal saline solution 4 oz. every 2 hours, and lactate of calcium 90 grains daily were given per rectum, and fortunately well retained. The urine became cloudy with phosphates in a short time as evidence of absorption of lime. Gelatin was administered in every way possible, with the saline enemata and in milk and beef extract, to the extent of a pint or more daily. I should add that one of the important and difficult features of the management of such a case as this is in keeping the bowels free from decomposing blood clots and yet not draining the system by too free catharsis. So much depends on attention to these details, and it was only by the most competent nursing that this result was attained. On removal of compression hemostat and after resumption of liquid nourishment, in 48 hours the condition improved. Evidence of subacute otitis supervened, and either as result of this or extreme exsanguination he became very deaf. The temperature was elevated one or two degrees and the pulse was almost constantly above 130. Blood mass, 1 gr., three times a day was begun on third day. On the fifth day there was nasopharyngeal hemorrhage, but on account of the otitis I did not think it best to make direct application of irritating styptics to the nasopharynx, and it ceased temporarily.

During the night of the fifth day there was violent bleeding from the right tonsil. As in the left there was no distinct point of hemorrhage but a general free oozing, and again I had to apply the compression forceps. There were the same symptoms of congestion and a more marked edema of the face, and free nasopharyngeal and nasal hemorrhage at intervals during the seven hours of compression. It was astonishing how well the child tolerated the forceps. He seemed to have greater dread of the hemorrhage and would even sleep with the clumsy instrument in place. In seven hours it was removed and there was no more bleeding from the right tonsillar fossa.

The child seemed to have about reached his limit of recuperation. He was at this time extremely pale, pulse feeble and rapid, 130 to 150, and the blood as it escaped looked like pink serum. On two occasions we actually prepared for transfusion by the method of Crile, as the case seemed so desperate and hopeless, but the hemorrhage became less copious,

and more easily controlled, and the operation was postponed. The tubal congestion gradually subsided and the hearing improved by the eighth day.

At this time the hemoglobin percentage was 28 (Dare) and it had probably been lower. From the eighth to the eleventh day there were frequent hemorrhages from the nasopharynx. By means of the Killian self-retaining palate retractor I could make direct compression for several minutes in the nasopharynx, using Monsel's solution. It controlled the hemorrhage for 6 to 12 hours each time, and by vigilance we were able to prevent any considerable loss of blood. On the eleventh day the left tonsil again bled freely. This was ten days after removal of the hemostatic forceps, and it was indeed very discouraging. I controlled this by pressure and application of Monsel's solution. Every 6 or 12 hours blood would flow, the usual nervous excitement follow, and the higher pulse rate and tension increase the bleeding. Finally on the twelfth day I began the method of anticipating the hemorrhage. Every 6 hours firm pressure was made with swab saturated with Monsel's solution in the left tonsillar fossa and nasopharynx. Instead of causing dread and excitement this routine seemed to give the child confidence and quiet his fears. The last bleeding was on the fourteenth day after operation, but the treatment was continued at longer intervals for some days. Convalescence was slow but complete.

I should add that adrenalin was tried during the first hemorrhages but seemed of no benefit. During the last stages, when the nasal and nasopharyngeal bleeding was slight but persistent, I used pledgets saturated with 1:1000 solution in nares with good results as to nasal oozing. It seemed very useful in preventing slight hemorrhages but of little service in checking the flow when once established. (Drs. C. N. Smith and N. W. Brown were in frequent consultation and directed the general treatment.)

*Comments.*—The operation was perfectly done, and there was no traumatic laceration in the epipharynx or tonsillar fossae. Concealment of the hemorrhage was one of the trying features throughout. This was in part due to the character of the blood in this diathesis. Clinical observation of such a case tends to confirm the theory of retarded coagulation.



The clot was certainly of the ordinary consistency and the fibrin mass was firm and very tenaciously adherent to the oozing surface. One could see a firm clot almost decolorized near the fossa and hanging several inches into the esophagus, down which fresh blood was flowing.

Compression forceps were applied in all fourteen hours. It may have been longer than necessary, but the instrument was well tolerated and it was the proper procedure in this case.

One of the essentials in the use of any hemostatic appliance or coagulant is that the bleeding surface shall first be absolutely freed from fibrin clots. This was done by means of the curette forceps. I found the Monsel's solution very satisfactory. It does not form the firm, leathery, shrinking clot that is characteristic of the powdered persulphate or chloride of iron which conceals bleeding, and it is not so irritating but that it can be repeatedly applied.

Calcium lactate was given per rectum in thirty to ninety grains daily for more than two weeks, and gelatin to the amount of about a pint daily during the same period. The effect could not be definitely determined, but the end result justified their administration.

This case merits a brief consideration of surgical procedures other than those applied. It was evident that the bleeding was not from any particular vessel, and on my first inspection it was apparent that stitching the pillars together would not compress all of the bleeding surface. It came from the whole fossa. At this time I did not fully appreciate that the patient was a hemophiliac and it was very fortunate that ligation of the external carotid was not attempted. Radical surgical procedures should not be resorted to prior to determination of the true nature of the hemorrhage.

*Heredity.*—Parents healthy and the patient was the youngest by twelve years of the three children. A sister has exophthalmic goitre, and has undergone ligation of the arteries. The father had a severe epistaxis when about four or five years old, not traumatic, and it bled for several days until he was seriously prostrated. Maternal grandfather was called a "bleeder." He had a prolonged, severe hemorrhage from a tooth socket and while still a young man died of pulmonary hemorrhage supposed at the time to be caused by tuberculosis.

The patient had several suggestive but not severe hemorrhages from an injury to the frenum of the upper lip when an infant. Other than this the tendency to bleeding had not been observed. From the family record alone one is scarcely justified in calling him an hereditary hemophiliac, but the clinical history here narrated is quite typical, and temporarily, at least, he should be so classified, and it shows how very difficult it is for the surgeon to secure that information which would protect the patient and himself.

*Case II. Scorbutus, Epistaxis.*—M. C. This case illustrates the importance of the study of epistaxis as a symptom. It is not always a local lesion and the successful treatment must be general as well as local. The call was an urgent one, a case of epistaxis of three days' duration, several physicians having in vain attempted to check the hemorrhage. I found a young girl in a state of extreme exsanguination. During the examination syncope with complete loss of consciousness came on, no pulse perceptible, lasting about ten minutes. The blood-soaked condition of the bedding corroborated the statement of the parents that she had lost much blood, and, worse, she was still bleeding. Partial inversion and hot saline enemata aided in restoring to consciousness and permitted examination. There was a general oozing from the anterior third of the septum, and also from the turbinate, rather than a distinct arterial hemorrhage. I made the natural error of attempting to seal the vessels by the fused chromic acid method. She still bled. Adrenalin was inert. Only by packing firmly with gauze was it finally controlled.

The patient was carefully nourished and her appetite, ravenous after the fasting and drain of blood, was gratified in every way. But she still bled profusely at intervals during two weeks. I had labeled her an hemophiliac when I incidentally observed the condition of mouth and skin, and then I did what should have been done earlier; that is, study the case and search for the systemic cause. (General examination by Dr. N. W. Brown.) Patient a girl of ten years, undersized, anemic, skin dry and of dusky color, visceral examination negative. Gums swollen and spongy and frequent bleedings from the mouth for some months, and also hematuria. Tongue thick and dry and covered with small petechiae. The mucous membrane of the cheeks and pharynx

showed small hemorrhagic areas. Conjunctivae normal but eyelids puffy. Indurated swellings were noted in the left popliteal space over the thigh and also over the sternum, all showing more or less ecchymosis. Urine contained a trace of albumin and a few corpuscles. Blood: red blood corpuscles 3,412,000; Leucocytes, 9,800; Hemoglobin, 60 per cent. Coagulation period 6 to 7 min. The question of diagnosis involved hemophilia, purpura hemorrhagica and scorbutus. There had been no suggestive traumatic bleeding heretofore, nor hereditary evidences, and time of coagulation was not delayed. Purpura was excluded by absence of fever, the relative lymphocytosis and general character of the attacks.

The commonly observed etiologic factors that aid in diagnosis of scorbutus as seen in infancy are difficult to determine in a child of this age, but a careful inquiry gave evidence that she had never had proper food and lived in wretched hygienic conditions. The history brought out the fact that she had been in the scorbutic state of malnutrition for many years; rheumatoid pains in the limbs, hyperesthesia, muscular soreness, transient edema of the skin, with or without ecchymosis, sore bleeding gums and epistaxis being the symptoms observed. The crucial test in the diagnosis of scorbutus is the response to proper dietetic treatment, but in adults with long existing lesions and perverted physiologic habits the improvement would naturally come more slowly. In this instance it was noticeable that she gained steadily, and gradually all of the symptoms vanished. The relatives, alarmed by the desperate condition as described, came to the rescue and she was well fed and lived as never before. The diet consisted of fruit juices, fresh vegetables, beef and milk. Iodide of iron was prescribed and the treatment of the mucous membranes was of cleansing healing character rather than the usual styptic or escharotic remedies to stop hemorrhages. She was free from all evidences of the diseased condition in a few months, and remained well for eighteen months when last seen.

#### GENERAL REMARKS ON THE HEMORRHAGIC DIATHESIS.

The hemorrhagic diathesis can be divided into two classes, the pathologic and non-pathologic. To the former belong those diseases characterized by unaccountable hemorrhages



into the skin, mucous membranes, joints, organs, etc., with or without peculiar inflammatory conditions, such as scurvy, purpura hemorrhagica and allied diseases. The condition known as hemophilia alone represents the non-pathologic class. The modern teaching of pathology that such diseases as purpura and possibly scurvy are probably due to a micro-parasitic pathogenic agent still further emphasizes the necessity of such a distinguishing classification, and further, purpura and scurvy exhibit none of the hereditary characteristics of hemophilia.

All of these manifestations of the bleeding tendency have apparently certain features in common. The most prominent is the frequent involvement of the joints such as rheumatic arthritis and hemorrhages into the joints. This similarity is due in part to a somewhat loose application of the term hemophilia. Hemophilia is not a pathologic process, but a permanent condition (Litten). It is intensely hereditary. It is probable that many of the cases of so-called acquired hemophilia are manifestations of the hemorrhagic diathesis of pathologic character. In females it is shown by the tendency to transmit, and in males it becomes manifest. Women from bleeder stock, but not bleeders, are called "conductors." Late statistics show, however, that the proportion of females to males who manifest the disease is somewhat higher than was formerly accepted, it being 1 female to 13 males. Males may be "conductors" of the disease, but comparatively rarely. The theories advanced to explain hemophilia present so many contradictions that pathologists have, as a last resort, declared that it is not due to a pathologic condition in the ordinary acceptance of the term. It is quite generally accepted that the time of coagulation is lengthened. The test should be made of the blood drawn from a fresh prick rather than taken from a bleeding wound, on account of the fact that in the normal subject hemorrhage shortens the time of coagulation, and especially at the point of bleeding. Statistics show that the anatomic regions most frequently manifesting the "love of bleeding" are those of particular interest to our special art. More than fifty per cent are nasal hemorrhages, and the most fatalities also, about twelve per cent are of the mouth, and five per cent of the lungs. Nineteen cases of hemorrhages from extraction of teeth proved fatal in six instances, and to

still further clinch our interest it should be mentioned that the period of pathologic development of lymphadenoid tissue is the period when the tendency to bleeding is most liable to become manifest. The tendency to arthritic inflammation peculiar to hemophiliacs also calls attention to our anatomic preserve, the lymphadenoid ring, as the channel of infection.

For the protection of all concerned, surgeon and patient, a casual questioning will not always suffice to bring out the essential facts, as the absence of a "bleeder" in one generation engenders a false feeling of permanent security and the hereditary fault is forgotten. In the case reported in this connection I had made inquiry during the first three or four days of bleeding as to whether any of the family had shown this tendency, but it was not until the fifth day that the mother made the remark incidentally that her father was a "bleeder." Her immunity broke the continuity of heredity in her own mind. To facilitate a proper direction of inquiry before committing a surgical blunder the laws governing hereditary transmission are presented:

1. Daughters of a bleeder father are exempt, but may transmit to male offspring. (Crile.)

2. The sons of bleeder fathers are also as a rule exempt and do not transmit to their offspring.

3. The daughter of a bleeder father may transmit the disease to a single one, to several, or all of her offspring.

4. Where there are several daughters, the capability of transmission to offspring may be confined to one or all of the daughters may transmit it.

5. Occasionally there is direct transmission from father to son through several generations.

6. The disease does not appear in the issue of the sons of a bleeder family who are not themselves bleeders.

7. There is not always evidence of any hereditary influence so far as can be discovered by the record of ancestors.

The differential diagnosis between hemophilia, purpura hemorrhagica and scorbutus has an important bearing on treatment. Certain cases of hemophilia having no clear record of heredity may present symptoms, in so far as local hemorrhagic lesions are concerned, quite similar to purpura and scurvy, but a careful study of those general symptoms

which characterize a disease caused by a microparasitic agency or one associated with malnutrition will usually aid in clearing up the diagnosis. Prostration, fever and relative lymphocytosis are not characteristic of hemophilia. In scurvy, as seen in children, all of these systemic symptoms are found, but the diagnosis can usually be determined by inspection of the mouth. Swollen, bleeding gums and mucous membrane petechiae are characteristic. Purpuric spots on the skin, spontaneous or caused by slight traumatism, and above all, the evidences of malnutritional lack of development complete the clinical picture.

The true diagnostic test of scurvy is found in effect of treatment. Such patients respond quickly to a generous varied diet, including fresh meats, fruits, vegetables and orange and lemon juice.

*Hemorrhage.*—Two or three per cent of body weight can be lost without materially altering blood pressure, but the blood pressure is maintained at the expense of increased action of vascular nervous energy and that individual cannot withstand shock as well as one whose vascular nervous function has not been overtaxed. In a child weighing 30 pounds, from 6-10 to 9-10 of a pound, or nearly a pint of blood, can be lost without materially altering blood pressure (Crile).

Crile calls particular attention to one very important point in the pathology and treatment of hemorrhage. The vital nerve centers will not stand a prolonged or considerable degree of anemia without permanent damage. In these cases of prolonged hemorrhage, as obtains in the hemophiliac, this point must be kept distinctly in mind in watching for approach to the danger line.

In nose and throat operation concealed hemorrhage is often the cause of serious degree of exsanguination. How much of the blood swallowed is digested is an important question. It must be that a considerable part of it is restored to circulation, especially in prolonged bleedings. In the case reported this observation was made several times. A bleeding would occur as shown by bloody expectorations, and even during this bleeding he would take nourishment. An hour or so later the vomitus would contain dark, partially disintegrated clots, but no traces of the milk or gruel which had been recently swallowed. Blood clots in the stomach certainly did not stop digestion, and were partially digested.



Systemic and local treatment considered from standpoint of laryngologist, and with special reference to postoperative bleeding following tonsillectomy and adenectomy and nasal operations.

Calcium salts are probably the most commonly used drugs to increase blood coagulation. Calcium lactate has, to a considerable extent, superseded the chloride, as it is better tolerated. In children it should be given by rectum in half drachm doses two or three times a day and at longer intervals as the bleeding decreases. Iron or arsenic should be administered. These cases are usually long drawn out and every effort should be made to aid recuperation by maintaining nutrition. Exclusive milk diet, administered at short intervals, is considered to be of material benefit in increasing coagulability of the blood. Liquor thyroidei as well as adrenalin are possibly useful in checking obstinate hemorrhage in certain individuals, but there are no definite indications, and we may consider both to be still on therapeutic trial. One cannot afford to tamper with physiologic functions in critical cases and only clear indications should be followed. Stimulating drugs should be avoided in hemorrhage at any stage. The first indication is to maintain the volume of circulating medium and the physiologic solution of blood salts accomplishes this. The method of administration depends on the age and tolerance of patient and urgency of symptoms. If it be retained, enemata are the simplest and least disturbing. Small portions, 4 oz., given every 2 hours, is the best for children. If this fails, intracellular injections should be tried. Intravenous injections may be indicated, but only in emergency. In some cases it is advisable to maintain a steady sustaining supply of physiologic saline solution by means of continuous rectal injection.

If there is no response to the saline injections the serum method may be tried. Weil and others advise repeated small injections of fresh human or horse serum. Intravenously 10 to 20 c. c. or subcutaneously 20 to 30 c. c. should be given, and repeated in twenty-four hours if necessary. The difficulty is to obtain fresh serum, and this is essential, as the fibrin ferment, which aids in restoring coagulability to the blood of the recipient, is not permanent and disappears rapidly from the serum. Certain individuals are "sensitized" to

horse serum. This danger can be, in a measure, safeguarded by giving a small dose, 1 c. c., and if no central or vasomotor disturbance be noted in fifteen or twenty minutes, the larger dose can be administered.

If fresh serum is not available, diphtheria antitoxin serum may be given in the same manner as above outlined, but it would be less efficacious in promoting coagulation.

K. Wirth, in Vienna Letter, N. Y. Med. Rec., May, 1909, reports eight cases treated with horse serum. One was hemophilia, tonsillotomy, epistaxis. All of the eight cases had been treated by usual methods without benefit, and responded favorably to 20 c. c. subcutaneous injections of horse serum.

The method is not without danger, and the practice of making test injections of 1 c. c., as mentioned above, is advised.

*Transfusion.*—Carrel, Crile and others have demonstrated that direct transfusion of blood is a practical surgical procedure. It requires a refinement of surgical dexterity that is not given to every operator, but the chief difficulties have been overcome, and its field of usefulness outlined so that we may have a reasonable faith that in every hospital will soon be found the talent to apply it. It would seem that the true hemophiliac is an ideal subject for transfusion. Fortunately they are rare, but it would not be astonishing to find that there is a possibility of more or less permanently improving the blood in so far as coagulability is concerned, rescuing these doomed unfortunates from the dreaded fate that hangs over them. I have investigated one family of "bleeders" in which three sons of one generation died of traumatic hemorrhages. One of these I saw at the time when he suffered amputation of the arm after many futile attempts to check a bleeding of the hand which started from a slight cut. He recovered from this, but died soon after of another slight traumatic hemorrhage. Two sisters had sons who were bleeders. One lost two and the other one from hemorrhages; six deaths in two generations. This seems, as stated, an ideal field for application of transfusion. I shall only refer you to Crile's admirable book on Hemorrhage and Transfusion, convinced that the study of this subject and his work in perfecting this operation is of peculiar importance to throat and nose surgeons.

#### IV.

### A STUDY OF SOME CASTS OF THE INFANTILE PHARYNX WITH SPECIAL REFERENCE TO THE EUSTACHIAN TUBES.

BY WILLIAM C. BRAISLIN, M. D.,

BROOKLYN.

The very considerable differences in relative size and shape between the pharyngeal cavity of infancy and of adult life form the basis for the following remarks:

Casts of metal or plaster are found useful in demonstrating the topography of this region. For purposes of photography those of the latter material, though more fragile, have superior advantages.

The photographs accompanying this paper were made from casts of fresh uninjected material as well as from specimens hardened in formalin solution. In order to demonstrate certain details, photographs of the tissues themselves have also been used.

The naso- or rhinopharynx is generally understood to include that portion of the respiratory tract posterior to the nares and above the level of the soft palate. It is so treated here. This tract is meant in all mention of the pharynx, nasopharynx or rhinopharynx in the present paper.

An examination of the pharynx of the new-born reveals a cavity with its long axis in the horizontal, rather than the vertical plane as in the adult. The long diameter of the infantile pharynx is anteroposterior rather than superoinferior. The cavity is relatively low and elongated, wide and flattened from above downward, approaching more nearly the shape of certain mammalia of a lower type than that of the human adult. The roof or vault of the infantile pharynx is nearly rectangular. On its surface is distributed the pad of lymphoid glandular tissue arranged in rather prominent folds. The folds diverge as from a center, the outer ones to the full width of the roof, and again converge toward the posterior edge of the nasal septum.



The pattern is fairly regular, though by no means constant. The rugae are distinctly visible in all the new-born specimens studied except in one very much emaciated child, where the vault was perfectly smooth and free from rugae. In fat infants they seem more than usually prominent. They have been noted well developed in the seven-months embryo and may often doubtless be visible, even on gross dissection, earlier. These folds usually retain their characteristic pattern when hypertrophied (adenoids), and are often thus removed. Masses taken away by the sharp curette, especially, frequently exhibit the characteristically shaped rugae, with deep creases between. At the center of the pharyngeal vault where the folds converge, in four of my specimens, a somewhat duct-like opening (the pharyngeal bursa) was seen.\*

Behind the pad of glandular tissue which in the new-born extends but little posteriorly to the center of the roof of the pharynx, the mucous membrane is smoothly continuous with that lining the posterior and side walls. This portion of the mucous membrane after preservation in formalin solution, assumes fine transverse rugae in both infants and adults, being occasioned doubtless by the contraction of the fibers of the superior constrictor muscle. The anterior wall, composed of the posterior nares and septum differs from the adult in the following particulars: The posterior nares are wider and shallower, approaching in shape a pair of equilateral triangles placed on their bases, side by side, the septum like a widely spread V between them. (See Fig. 4.)

The infantile postseptal border arches very gradually from the horizontal plane at its superior attachment until near its inferior attachment, when it suddenly angles downward to the articulation with the horizontal plates of the palate bones.

The lateral walls in infancy show perhaps the widest differences from the adult of any of its boundaries, exhibiting the characteristics of this shallow and relatively long cavity. The most conspicuous landmarks are the prominences of the cartilaginous extremities of the Eustachian tubes which stand out sharply from the side walls, separating the depression of the

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\* Openings of this character may sometimes be observed in older children elsewhere in the pharynx. The writer has seen a case where several such openings were visible in a youth of seventeen years apparently as a result of inflammatory changes in unoperated adenoids.

pharyngeal mouth of the tube in front from that of the longer, more extensive and equally deep depression forming the fossa of Rosenmüller, behind. The prominences of the cartilage receive the direct impingement of the air current, inspired through the nares, and in some degree deflect it across the mouths of the tubes below, and against the roof of glandular tissue above. In the new-born the Eustachian cartilages are crowded closely to the roof of the nasopharynx. They narrow the cavity somewhat from side to side. Anteriorly to, and below, the cartilaginous prominences, at the depression of the mouths of the tubes and behind and above them (fossæ of Rosenmüller), the cavity of the infantile nasopharynx reaches its extreme width. The depressions created by the mouths of the tubes considerably widen its transverse diameter at this point, and this is likewise the part of the nasopharyngeal cavity of the least vertical diameter.

The mouths of the tube lie, relatively to the septum, more posteriorly in the infant than in the adult. Instead of being on a direct plane with the septal edge as in the adult, they are  $\frac{1}{8}$  inch posterior to it. This discrepancy is due to the lesser development of the vomer in the new-born.

Traces of the salpingopharyngeal and the salpingopalatine folds, one or both, may be noticed in the infantile pharynx. These follow the long axis of the cavity in both cases so that they extend more nearly horizontally in the new-born than, as in the adult, vertically.

The mouths of the Eustachian tube are relatively more nearly on a level with the floor of the nares than in the adult. They are bounded above by the prominences of the Eustachian cartilages while the lower lip merges into the floor of the cavity (soft palate). The muscles underlying the mucous membrane at this point, the levator and tensor palati, are both relatively well developed; both, however, taking more nearly horizontal than vertical directions than in the adult, from origins to attachments, due, in part, to the lack of development of the pterygoid processes of the sphenoid and to the inferior depth of the cavity of the nasopharynx in the infant.

The floor of the pharynx of the new-born compares closely with that of the adult. Its palatal portion is of greater diameter, anteroposteriorly. This is due to the vomer being relatively smaller and more anteriorly placed in the infant and the hard palate likewise relatively shorter, anteroposteriorly.

The differences in the form of infantile and adult nasopharynx depend directly and primarily on the bony framework of the surrounding structures, so that it is necessary to refer briefly to these, in order to elucidate the main causes of differences of the size and shape of the nasopharyngeal cavity of the new-born.

The sphenoid bone presents at birth little evidence of the subsequently marked development of the pterygoid processes of the adult. The vertical plates of the palate bones are likewise very short. The vomer, which in adult life extends its superior articulation to the posterior edge of the body of the sphenoid, articulates in the new-born with only the anterior half of the inferior surface of the sphenoid, in other words, it is relatively as well as actually smaller in the infant. The ethmoid, together with the bones of the face, have yet to undergo the development which increases so greatly the nasal mucous surface.

The superior maxillary bones including the hard palate (palate processes) are relatively small.

In the new-born the nares are apparently of inferior relative importance, while the pharynx from its greater length appears to be of relatively superior importance. It seems probable that in infancy a greater relative amount of the function of warming and moistening the respiratory stream is performed by the pharyngeal mucous and lymphoid tissues than by the nasal surfaces.

The dimensions of the infantile nasopharynx (from the average measurements of my series of casts of twelve specimens) are, width at fossæ of Rosenmüller and also at Eustachian tube mouths, 1.4 cm. ( $\frac{1}{2}$  inch), depth, at plane of tubal orifices, .4 cm. ( $\frac{3}{16}$  inch) to .8 cm. ( $\frac{1}{4}$  inch) or greater, posteriorly, as the floor, following the curve of the soft palate, descends. The horizontal portion of the vault is 1.5 cm. ( $\frac{5}{8}$  inch) anteroposteriorly, and posteriorly, as it gradually curves downward into the posterior pharyngeal wall, the distance is as much greater. The horizontal portion of the floor of the nasopharynx (upper surface of soft palate) is relatively longer, as the hard palate (palate process of the superior maxillary) is relatively short, in the new-born than in the adult.

The anteroposterior attachment of the vomer to the body of the sphenoid in the adult extends nearly or quite, to the posterior edge of the body of sphenoid. In infants, it extends



across about half the body of the sphenoid, and the vaginal processes of the sphenoid do not enclose the vomer.

The shallow pharynx of the infant under five years, especially under three years, makes the use of any but specially adapted forceps for the removal of adenoids less applicable than in older children and adults. I believe that a curette is preferably employed, and as a result of experience, I think this should be broad, rather flat-bladed and quite sharp. If the blade is dull, little good will be accomplished, and partly detached portions of the growth may remain.

The writer wishes to acknowledge his indebtedness to Dr. Jonathan Wright, Dr. C. Schradieck, Dr. E. L. Oatman, and others, for generous assistance rendered in the preparation of this paper.

#### CONCLUSIONS.

1. The nasopharynx of the new-born is low, broad and relatively long. Its shallowness is due to the undeveloped state of the bones of the cranium, face and cervical vertebræ chiefly, the pterygoid processes of the sphenoid, the palate bones, the palate processes of the superior maxillary bones (hard palate) and of the vomer.

2. The inferior development of the nasal cavities may be responsible for a transference of greater relative respiratory importance upon the pharyngeal tissues. This may perhaps account, in part at least, for the lymphoid tissue of the infant being the seat of a relatively greater degree of hypertrophy than in the adult. As age advances, the growth of the bones of the cranium and face is very rapid, the vault of the nasopharynx becoming higher.

In adult life the vault is higher and apparently more withdrawn from the direct air current, although if the tissues remain normal, the functions of warming and moistening the inspired air are here still in part performed.

3. The difference in structure of the nasopharynx of the young infant indicates a somewhat different course of procedure in operations for the removal of adenoids. In infants of two or three years or younger, adenoid forceps are rarely applicable. It is believed that in children under five years, a Gottstein's curette or some modification of it, is preferable. A sharp, flat-bladed and fairly wide instrument best meets the indication in the hand of the writer.



FIGURE 1.

Nasopharynx of new-born, its long axis more nearly horizontal than in the adult. The postseptal border is also more nearly horizontal than that of the adult. (Slightly reduced.)

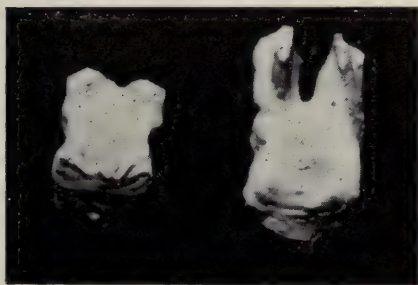


FIGURE 2.

Casts of new-born pharynges, superior aspects. In left cast the rugae are regular, in right (cast prolonged into posterior nares) the rugae are irregular.







FIGURE 3.

Cast of new-born nasopharynx, lateral and superior surfaces. T are the projections into mouths of Eustachian tubes. R of Rosenmüller's fossae. Elongated projections at left ends of cast are the extensions into the posterior nares, and indentations at the extremities of these are made by the posterior ends of the lower and middle turbinated bodies.

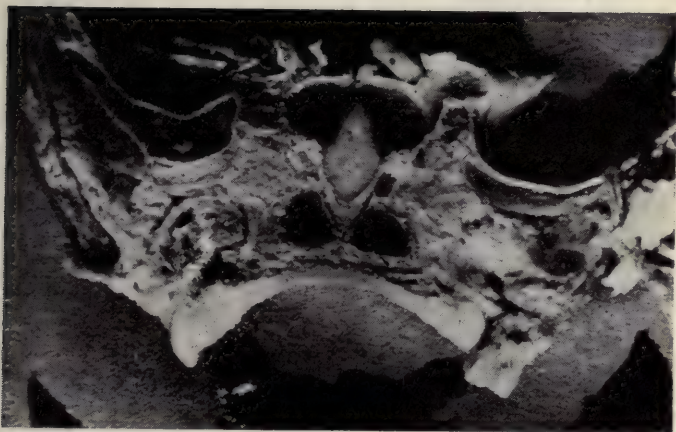


FIGURE 4.

Transverse vertical section just anterior to opening of posterior nares showing their triangular appearance.

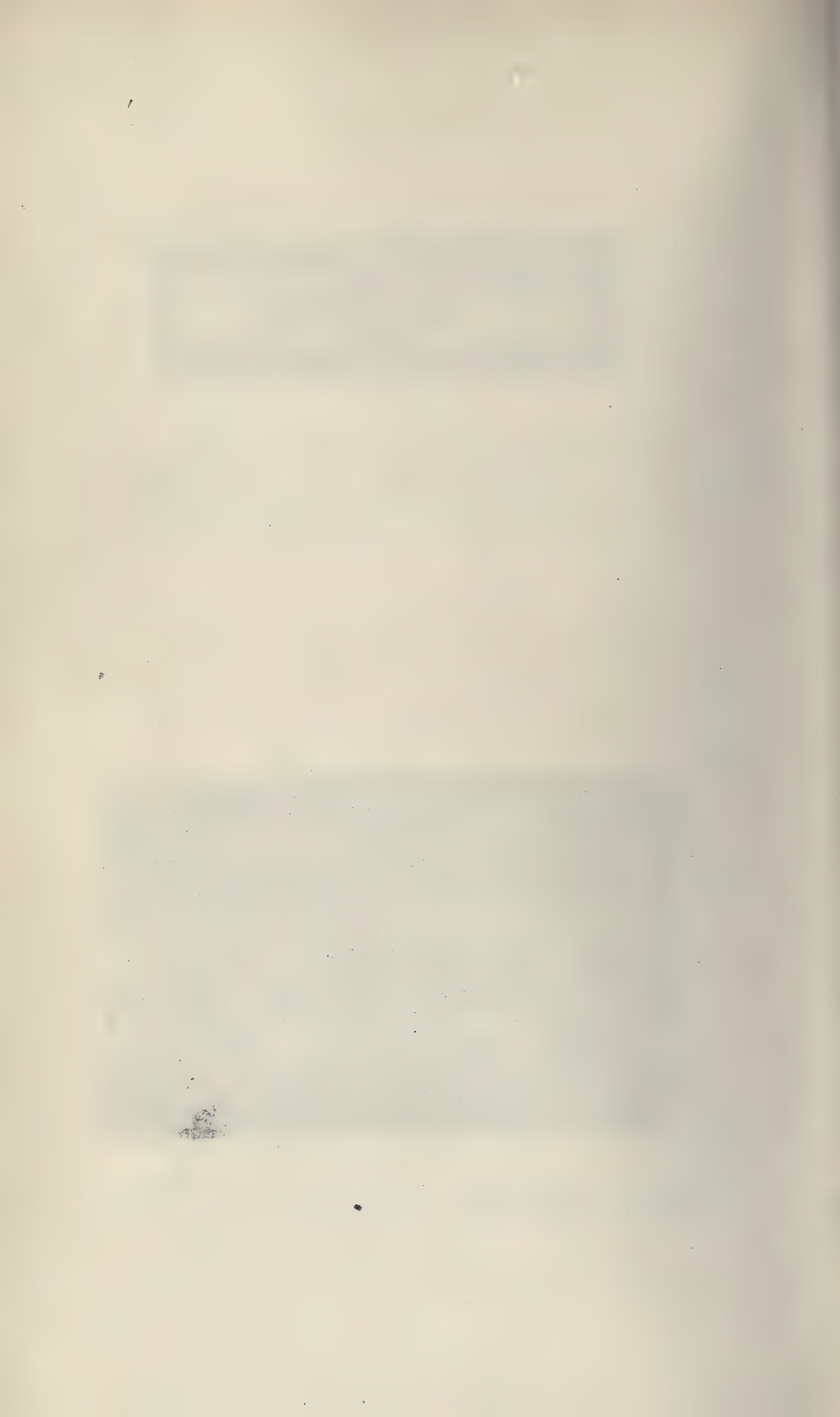




FIGURE 5.

Vertical cross-sections through three casts of nasopharynx of new-born (slightly enlarged). Figure on the left, at plane of mouths of Eustachian tubes; middle figure, at plane of posterior edge of septum; figure at right represents a cross-section within posterior nares.

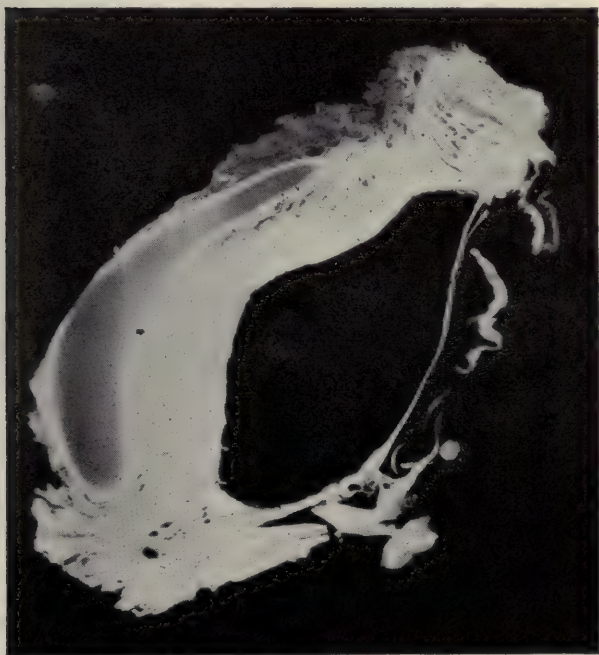


FIGURE 6.

Cross-section of the pharyngeal mouth of the Eustachian tube. The darker tissue (enlarged 7 diameters). Author's specimen. The line of the larger tissue at the left shows the Eustachian cartilage divided at its anterior, free, extremity.







FIGURE 7.

Cross-section of the tube, 2 cm. from pharyngeal mouth. Shows folds of mucous membrane within tube and relation to tensor muscles. Kindly photographed from the author's specimen by Dr. Edward L. Oatman. (Highly magnified.)





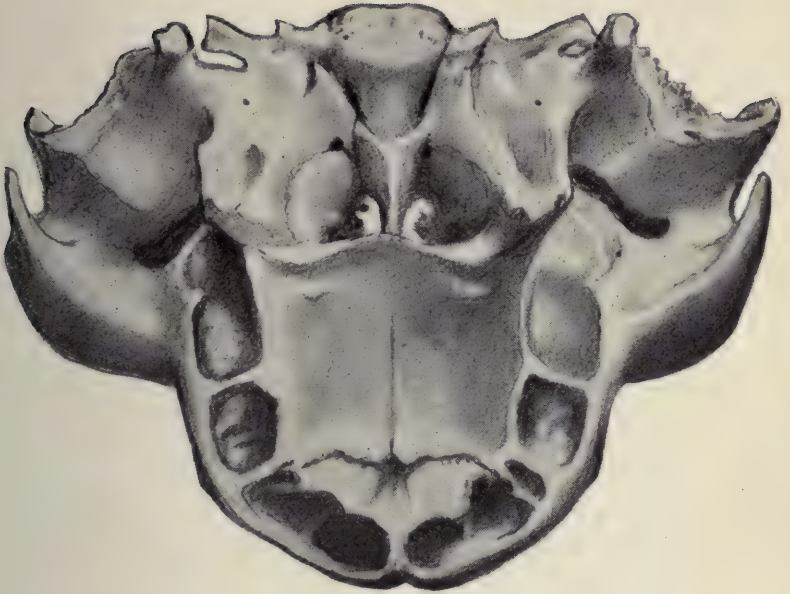


FIGURE 8.

Sphenoid, superior maxillary and palate bones of infant. Inferior development of pterygoid processes and of vomer as compared with same structures in the adult. Drawing made for writer from specimen loaned by Dr. H. Von W. Schulte. Almost twice nat. size.



V.

THE LARYNX OF MYCETES SENICULUS.  
(HOWLING MONKEY.)\*

BY J. HOLINGER, M. D.,

CHICAGO.

Several authors, among them Alexander von Humboldt, state that the voice of the howling monkey can be heard at a distance of more than a mile by actual measurement. Compare with this the fact that few steam whistles, pistol or even rifle shots may be heard at that distance, if especially favorable conditions like refraction and wind are excluded. One may then be pardoned for showing a specimen of the apparatus which can produce such powerful sounds, that a hunter standing under a tree where a family of howlers have their concert, feels pain in his ears. The nature of the howl varies from a low grunt to high pitched shrieks.

The teleogic cause of the howl is absolutely unknown. It is produced without any particular effort. The family of five to ten sit in a tree in a circle and father and mother and all the children howl while looking at each other, their solemn appearance accentuated by their long beards. This seems to me to exclude any sexual reason for the howling. The only explanation seems to be that they give their concerts for pleasure or perhaps to frighten away enemies. The first reason for howling is suggested by the fact that in captivity the animal never howls.

The construction of the larynx makes it impossible for the howlers to carry their head erect like other monkeys (see fig. 1), because the large larynx and hyoid interfere with an erect vertebral column. The mouth, the pharynx, and larynx differ from those of other monkeys, the trachea alone being like that of others. The hyoid bone undergoes the greatest transformation, its body forming the large bulla that you

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\*Demonstration before the Chicago Laryngological and Otological Society.



see between the two sides of the extremely high lower jaw (fig. 2 and 5). In close connection with this bony resonator is the thyroid cartilage which forms an oblong funnel with its margins rolled in. The cricoid cartilage and the trachea are but little different from other monkeys. In the large funnel shaped larynx there is a complicated apparatus which allows the animal either to breathe quietly through the rear passage and epiglottis or to direct the sound into the resonator. To see, however, all details we ought to have a fresh or alcohol specimen. The physical explanation for the production of those terribly strong sounds cannot be given.

According to Edmund Meyer (*Arch. f. Laryngol.*, XII), air bags or diverticula of the trachea and larynx are frequently in monkeys of higher and lower types. They are, however, not constant in the same family, not even in the same species, but vary from individual to individual in location, size, and form. They are not in that direct connection with the voice as the above described apparatus, but subserve different purposes. I may therefore be allowed to ask whether it is right to range these air bags in the same category with the powerful instrument of the mycetes which must date back in its development to comparatively early embryonal life.

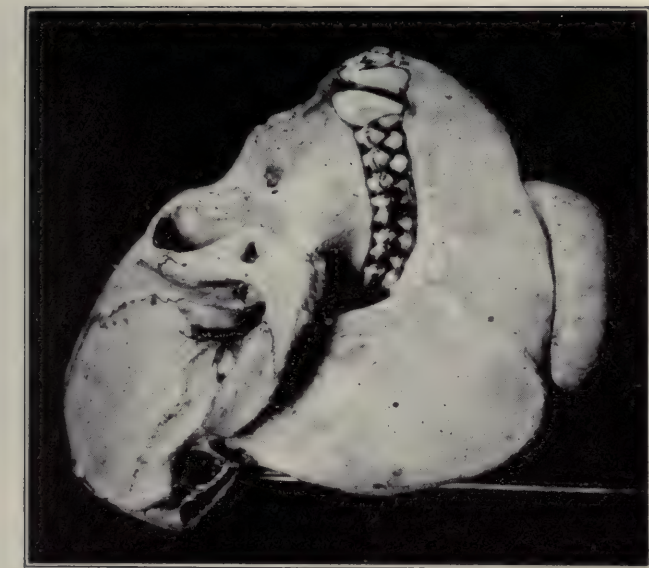
Finally I wish to thank Dr. McGibbons and Dr. Gary of the Field Museum for the demonstration and photographs of three or more dry specimens.



Figure 1. Full grown male. The head is carried low.







Figures 2 and 3. Front and side view of skull of the same. Note the high lower jaw and the bulla (hyoid bone) in place.





Figure 4. Hyoid and larynx in their relative position. For quiet breathing the air passes through the pharynx; for howling there is a separate opening leading to the resonator.

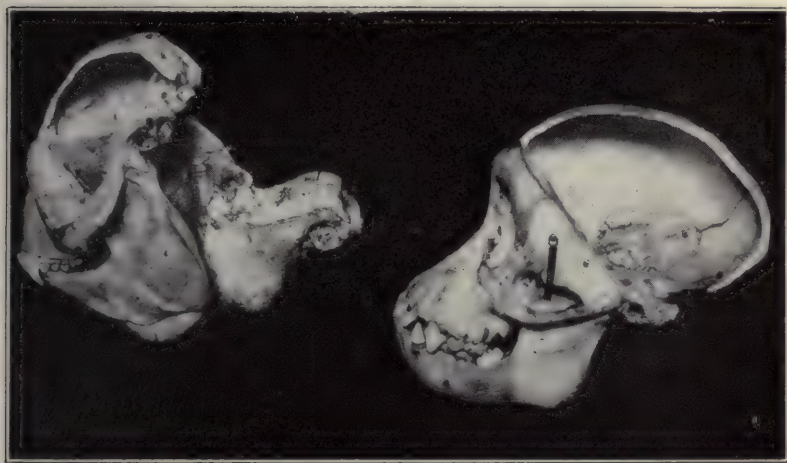


Figure 5. Same skull from behind and above, hyoid and larynx in place, skull cavity opened. To compare there is the skull of a chimpanzee of the same size. Note the different size of the brain cavity, the different form of the jaw (of interest is also a comparison of the ears, simple annulus tympanicus, no mastoid in the full grown Mycetes, well formed bony external meatus and a mastoid process in chimpanzee).







Figure 6. Specimen of Field Museum showing connection of the  
bulla with the thyroid cartilage.



## VI.

### ZOOLOGY OF MYCETES SENICULUS.

BY FRANK COLLINS BAKER,

CHICAGO.

The Howlers belong to the American group of broad-nosed, prehensile-tailed monkeys, which are much lower in structure than the man-like apes (Anthropomorpha). They are placed as a distinct subfamily, Mycetinae, of the family Cebidae, on account of the vertical lower incisors and particularly the enormously inflated hyoid bones which form a bulla or resonator. The truncated occipital region and the great width of the angular portion of the rami of the mandible, together with the very large size of the vocal organs, are among the notable characteristics of these monkeys. These organs are said to be developed to a great extent in the male.

The Howlers are related to the Hapalidae or marmosets on the one hand and to the Ateles or spider monkeys on the other. In the family Cebidae the species are much smaller than the members of the old world monkeys belonging to the family Cercopithecidae. There are six species of mycetes, to which genus the Howlers belong, which live in tropical America, from Central America southward. They are most abundant in the dense forest regions of Brazil, where they live an arboreal life. Mr. Bates, in his "Naturalist on the Amazons," says that, "when Howlers are seen in the forest there are generally three or four of them mounted on the topmost branches of a tree. It does not appear that their harrowing roar is emitted from sudden alarm; at least it was not so in captive individuals. It is probable, however, that the noise serves to intimidate their enemies."

In Brehm's "Thierleben" the following interesting note appears:

"The other American monkeys, whose voice is piping like a sparrow's, have a plain, thin hyoid bone; but in this species the tongue rests on an extensive bony drum. Their upper

larynx has six pockets which reflect the voice; two of these pockets are shaped like a pigeon's nest and resemble a bird's larynx. The plaintive sound peculiar to the Howlers is produced by the air forcibly streaming into the bony drum."

The Aluate or Red Howler (*Mycetes seniculus*), has a fur of auburn color, merging into golden yellow on the back; the hair is short and somewhat stiff. The average length of the male Red Howler is about four feet two inches, counting the tail as from twenty-five to thirty inches. The female is smaller and darker.

Schomburgk says: "For some time after my arrival I had, at sunset and sunrise, heard the fearful howling of the monkeys in the neighboring virgin forests, but had never succeeded in seeing them on my walks. One morning I set out after breakfast, provided with my gun, and a dismal howl just then resounding made me eager to kill some of these noisy disturbers. I hurried on through thick and thin, and after prolonged efforts succeeded in approaching a whole troop unperceived. They were right before me, in a high tree, and the concert they gave might have led people to believe that all the animals in the forest were engaged in deadly combat. Yet I cannot deny that there was some kind of harmony in the uproar, for sometimes the whole troop would pause, and then one of the singers would begin, and the dreadful howling would start afresh. The bony drum on the hyoid bone, which gives their voices such exceeding strength, could be seen moving up and down. For a few moments the sounds would resemble the grunting of a pig; the next instant they would simulate the roar of the jaguar rushing upon his prey, and then again came sounds like the deep and terrible snarl of the same animal, when, besieged from all sides, it recognizes its dangerous position. The dismal troop also had its ludicrous features, and the most confirmed misanthrope would have smiled if he had seen the grave and serious faces of the long-bearded vocalists."



## VII.

### A DISCUSSION OF THE VARIOUS INFLAMMATIONS OF THE ETHMOID BONE AS ADVANCED BY UFFENORDE IN HIS WORK, "DIE ER- KRANKUNGEN DES SIEBBEINES."\*

BY ROSS HALL SKILLERN, M. D.,

PHILADELPHIA.

Prior to Uffenorde's work on the ethmoidal labyrinth which appeared in 1907, this structure was considered only in connection with the accessory sinuses of the nose and no particular importance was connected with it which the remaining sinuses did not share. Empyema and mucocele were the conditions recognized, but beyond certain ophthalmic complications, the indications were practically those of the neighboring sinuses. Uffenorde, however, did not view these cells in the same light as the true sinuses, but comparing the ethmoidal labyrinth to a sponge and the frontal, maxillary and sphenoid to true cavities, he argued that these structures on account of their morphologic differences could not be affected in the same manner, or at least would not present the same symptoms and conditions when affected.

The ethmoid, he contends, occupies a peculiar position among the accessory sinuses of the nose. It forms quite a considerable portion of the lateral sinus boundaries, presenting a complex and irregular structure. Why then shall this structure not react in the most vigorous manner against the many noxae which the inner nose encounters? Moreover, the structure of the mucous membrane here is exceedingly tender and loose, which also reacts in a special manner. If this mucous membrane in acute inflammation exhibits polypoid swellings, why shall true polypus not occur under the influence of continued irritation, presupposing that polypoid swelling is but a fore-

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\*Read before the American Academy of Ophthalmology and Oto-Laryngology, October, 1909.

runner of polyp formation, both being classed under inflammatory hyperplasia?

After investigations extending over a period of some years, he divided the diseases of the ethmoid into:

1. Acute inflammation.
2. Chronic inflammation.
  - (a) Ethmoiditis hyperplastica cum polyposis.
  - (b) Ethmoiditis suppurativa.

Of the chronic inflammations, the one by far the most common and least recognized, at the same time presenting the most varied and complex symptoms, was that of ethmoiditis hyperplastica. This disease is caused by repeated and prolonged irritation (frequent attacks of coryza, influenza, long exposure to dusty surroundings, etc.) and is always confined in the beginning to the body of the ethmoid capsule, being characterized by polypoid swelling of the mucous membrane in the basal cells, the extent of this swelling and number of cells affected depending upon the degree and length of time the irritation was directed against the parts. This inflammation (polypoid swelling) spreads through the various cells of the labyrinth without regarding the ostia, in other words, as the mucous membrane of these cells is so intimately connected with the periosteum and bone that it practically forms an anatomic unit, the inflammation goes over from one structure to another really by continuity so that this polypoid inflammation will appear in a cell entirely closed from its diseased neighbor as far as an ostium is concerned. The appearance of polypi or polypoid swelling in the nose proper will depend entirely upon the position of the middle turbinate. If this structure lies close against the lateral wall of the nose (normal position) the ordinary rhinoscopic examination will disclose nothing abnormal unless the disease has progressed for a long period of time, in which case the middle turbinate will show pathologic changes. As the basal cells of the capsule are always the first ones affected and are the first to show pathologic changes, unless these are brought into view the entire process will remain undisclosed. This can only be accomplished by the so-called rhinoscopia media of Killian in which the middle turbinate is fractured at its insertion with the ethmoidal capsule whereby the bulla ethmoidalis and base of capsule is brought into view. After this procedure by visual in-

spection and by the probe, one can always accurately determine whether this body is diseased; as the irritation invariably comes from the inspired air, it naturally attacks primarily the basal cells, therefore the floor of the ethmoid capsule is the first to show pathologic changes. It is impossible, however, to judge the extent of the disease by mere inspection, as the confined conditions of the middle nasal passage are not propitious for the growth and retention of large polypi, polypi being merely considered an aggravated form of polypoid swelling. It is important to recognize the normal mucous membrane of the ethmoid and differentiate it from the diseased. The normal mucous membrane covering the bulla, outer side of middle turbinate and processus uncinatus is extremely thin and of a greyish red color, quite different from that of the septal side of the middle turbinate, that of the processus uncinatus being sharp and well defined. One can easily differentiate it from the pathologic with the help of the probe, an instrument which cannot be dispensed with in these cases. If the floor of the ethmoid capsule shows a constant swelling, one can safely consider that some portion of the ethmoid labyrinth is diseased. Opening the most dependent portion of this capsule, thus to say making an autopsy in vivo, will confirm our diagnosis.

Uffenorde also believes that chronic inflammation of the ethmoid with the formation of polypi has per se nothing to do with empyema but that it (hyperplastic ethmoiditis) is purely a simple catarrhal inflammatory change which takes its origin from the same noxa or noxae that cause general catarrh of the respiratory mucous membrane of the nose. Individuals suffering with this condition exhibit a marked tendency to "catch cold," during which period the secretion changes from a thin serous watery consistency to one of purulency, only to return to its original consistency after the suppurative stage of the coryza has disappeared. These symptoms must not be confused with those which occur in acute exacerbations of chronic empyema. With latent empyema all secretion is frequently absent, a circumstance never occurring in chronic hyperplastic ethmoiditis. Such cases of hyperplasia of the ethmoidal mucous membrane are often falsely diagnosed rhinitis vasomotoria, hay fever, etc. In these cases symptoms of nerve irritation coupled with a watery secretion often predominate. The hyperplasia of the ethmoidal membranes are

frequently entirely hidden by the middle turbinate and remain absolutely latent, but on the other hand, polypoid hypertrophy and polyp formation may on inspection be quite pronounced.

#### ACUTE INFLAMMATION.

This is characterized by a more or less pale edematous swelling of the mucous membrane which can assume large proportions. This condition occurs chiefly on the middle turbinate, processus uncinatus and bulla, and may take on a polypoid character which in the course of a few days can subside and return to normal, so that the next examination presents a totally different picture. Subepithelial hemorrhages and engorged capillaries appear here as in the diseased mucous membrane of the other sinuses. Acute inflammation may also be purulent from its onset, especially in the acute infectious diseases (influenza, scarlet fever, diphtheria, etc.). In this case the rhinoscopic examination presents a different picture. In addition to the purulent discharge the mucous membrane is swollen and deeply congested. These cases occur quite frequently, but usually subside after the very acute stage has passed, for generally speaking the drainage conditions are better in the ethmoid than in either the frontal or maxillary sinuses. The possibility, however, of orbital and cerebral complications is by no means precluded.

*Symptoms.*—By far the most important symptom is the headache, which can assume every possible grade of intensity, but especially taking on a sense of heaviness, coming on in paroxysms. This occurs particularly over the parietal and occipital regions in conjunction with lancinating and burning pains above and below the orbit, but especially over the root of the nose. Ocular manifestations, such as epiphora, weakness of vision, especially on reading by artificial light, and scintillations occur. Ciliary and orbital neuralgia, and in severe cases dizziness and vertigo, may be present.

#### CHRONIC INFLAMMATION.

Speaking of this form of inflammation, one must bear in mind that many cases of chronic sinus disease run their course without any trace of polyp formation, and on the other hand many cases of profuse polyp formation have occurred without any symptom of empyema. There re-



mains then the combined process, polyp formation in the ethmoid with purulent secretion. We consider the purulent process in these cases as a secondary infection, therefore accessory. One of the best criterions as to the correctness of this opinion is the pathologic condition of the inferior turbinate. In this body, with suppurative ethmoiditis one always finds atrophy, while with ethmoiditis hyperplastica, hypertrophy of this body is the rule.

Referring briefly to the histopathology of the polyp and its relation to the underlying bone, Hajek demonstrated that the periosteum of the middle turbinate extended down into the medullary bone spaces, thereby meeting and joining the endosteum in many places, forming an anatomic unit. As the inflammation attacks the periosteal structure, it is easy to conceive how readily the endosteum can become infected without regard to the cell ostia. We must therefore accept the theory that the inflammation spreads by continuity rather than by the infection, resulting from the purulent secretion, when present, which may trickle over and bathe the parts. This is also proven by the fact that the maxillary sinus may act as a reservoir for the frontal for a long period of time without becoming affected. Mucous polypi grow only in the line of least resistance, therefore if the basal cells of the ethmoid are the first to experience the irritation and consequent inflammation, it depends entirely upon the position and relation of the middle turbinate to the lateral wall of the nose, how much of the diseased process we can observe by anterior rhinoscopy. In those cases in which the middle turbinate lies close against the lateral wall of the nose, even after it has been infracted, the appearance of the base of the ethmoid capsule will not give us a definite idea of the extent of the disease, because there was not sufficient space for polypi to become prominent, and if the disease has progressed for a long period of time, the hyperplastic inflammation will be found in the superimposed cells. These cases present unmistakable subjective symptoms such as profuse watery secretion, intracranial pressure, lancinating pains over the eyes, pharyngitis, laryngitis and asthma. The severity of these symptoms depend largely upon the neurotic condition of the individual as well as on the extent of the disease, as in certain instances only the most dependent cells are affected, while in other instances the mucous mem-

brane of the entire labyrinth and even the sphenoid sinus has become polypoid degenerated, the severity of the symptoms being about the same in both instances. Why is a purulent secretion and often a true sinus empyema present in these cases?

When we recall that the polypi springing from the inflamed mucous membrane can become so numerous as to occlude the middle and superior nasal passages, it is easy to conceive how the ventilation and cleansing of these passages through blowing the nose is prevented, with subsequent infection and putrefaction of the stagnant secretion. In uncomplicated cases these polypi are continually bathed in the serous secretion which is drawn out of the inflamed mucous membrane, partially through osmosis and partially through gravity, and adds to the irritation of the parts already occasioned by the presence of the polypi, thereby furthering the likelihood of infection. On recalling the accepted theories of the mechanism by which the sinuses become affected, a secondary infection of one or more of these cavities under these conditions is but to be expected.

Empyema of the maxillary sinus coupled with chronic hypertrophic ethmoiditis frequently occurs in which it is impossible to state which was the primary and which the secondary infection. We take it, however, that the ethmoidal affection was always the primary.

Typical primary empyema of the cells presents a totally different picture from the above. The pale, glazed polypi or polypoid hypertrophies are here absent, their place being taken by fibrous swelling or oftener atrophy of the mucous membrane, purulent discharge, fetor, etc. A characteristic picture of empyema is the presence of crusts in the nasal passages, a symptom which always fails in chronic hyperplastic rhinitis. These symptoms, together with redness and thickening of the processus uncinatus, will be sufficient to differentiate the two affections.

*Symptoms.*—The patient has the experience of a continuous cold which is not influenced by the ordinary treatment. He also complains of frequent attacks of sneezing, a continual sense of tickling in the region of the superior nares, headache, sharp pains above and below the orbital cavity, ciliary neuralgia and a more or less profuse secretion from the diseased side.

One of the principal symptoms is the headache which manifests itself as a drawing, sticking pain between the eyes, above and below the orbit, sometimes radiating toward the temples. In acute exacerbations of chronic ethmoid disease the headache is severer, of a more diffuse character and radiates toward the occiput and mastoid process, which is also typical for affections of the sphenoid sinus. Occasionally there is marked dizziness, the patient experiencing the feeling as though the eyes were being bulged outward.

On the other hand, the affection may run such a latent course that the patient consults us on account of other troubles, such as disturbances of the olfactory function, pharyngeal affections, tinnitus or deafness. All these not infrequently take their origin from this disease. The olfactory sense is usually affected, partially through hypertrophy of the middle turbinate (anosmia respiratoria) and partially through anatomic changes (anosmia essentialis). Subjective kakosmia is not infrequently connected with this condition. An unpleasant taste in the mouth is often present in the morning, due to the fermentation of the secretion which has collected in the choanae during the night. This secretion during the day on account of its profuseness is most annoying, as the patients can scarcely keep their handkerchiefs out of sight, using from five to twenty daily. This abundant flow of secretion leads externally to maceration of the epithelium around the external nares, with subsequent eczema, and internally to pharyngo-bronchitis and asthma.

Among the sequelae may be enumerated pharyngitis lateralis, hyperplasia of the pharyngeal and faucial tonsils, eustachian and middle ear catarrh. The orbital manifestations of chronic hyperplastic ethmoiditis are of especial interest not only on account of the obscure picture which they often present, but also on account of the frequency with which they appear. These are usually of mechanical origin, due either to the intracellular pressure from the hypertrophied mucous membrane or from stasis in the hematogenous or lymph channels or both.

These may be enumerated as follows:

1. Interference with the mobility of the bulb.
2. Irritation of the optic nerve through pressure.
3. Changing the refraction of the bulb.
4. Disturbance of physiologic lacrimation (epiphora).

The subjective symptoms consist of scotoma, neuralgic pains in the bulb, ciliary neuralgia and photophobia. In severe cases vasomotor disturbances, such as hyperemia of conjunctiva and edema of eyelids and periorbital tissues may occur. The appearance of these reflex neuroses is but to be expected when one recalls that the orbital and nasal cavities are supplied by the same sensory nerve.

#### CONCLUSIONS.

1. The ethmoid bone is subject to the following inflammations:

- (a) Acute inflammation.
- (b) Chronic hyperplastic inflammation cum polyposis.
- (c) Chronic suppurative inflammation.

2. Hyperplastic ethmoiditis results from continued irritation of the mucous membrane without infection, when infection occurs an empyema results.

3. One can always judge whether the ethmoid is diseased after infracton of the middle turbinate. The irritation being coincident with the inspired air, always primarily attacks the basal cells, therefore the floor of the ethmoid capsule is the first structure to show pathologic changes.

4. Hyperplastic ethmoiditis presents a much stronger line of symptoms than suppurative.

5. Rhinorrhea is due to hyperplastic ethmoiditis. The middle turbinate is swollen against the ostia, the mucous membrane engorges upon itself and the secretion becomes squeezed and sucked out.

6. Typical suppurative ethmoiditis runs its course without polyp formation and simple hyperplastic inflammation without pus.

7. The presence of pus in hyperplastic ethmoditis is due to irritation and infection, fetid pus is due to saprophitic infection.

2032 Chestnut Street.



## VIII.

### A NOTE ON EUSTACHIAN OBSTRUCTION.

BY WILLIAM C. BRAISLIN, M. D.,

BROOKLYN.

The following note is the result of an effort on the part of the writer to differentiate obstruction or inflammation of the Eustachian tube from concurrent inflammation of the tympanic cavity. This naturally led to a careful inquiry from patients as to the presence of purely tubal symptoms in all kinds of ear diseases. Some of the conclusions reached, having proved of interest to the writer, are recorded.

Absolute occlusion of the tube is believed to be of extreme rarity. It is very much open to question whether those tubes which on Politzerization seem impermeable are entirely so. Bezold stated (1895) that he had not met with atresia of the tube in his autopsies.

In almost all cases of acute pharyngitis (and rhinitis) the mouths of the tubes are at least congested; they may be edematous, and active inflammation may extend along their lining membrane. In lymphoid tissue hypertrophies, the tubes are more or less obstructed.

It is a matter of common observation in examining the ears of patients suffering with an ordinary "head-cold" to find that there is more or less congestion of the ear, noticeable in a diminution of the luster of the membrana tympani. In these cases all subjective symptoms referable to the ears or tubes may be absent.

*The Eustachian Tube as a Drainage Way.*—The patency of the tube is usually sufficient to allow fluids, as blood, pus or serum, to drain from the middle ear into the nasopharynx. For example, the passage of blood into the throat and thence into the stomach is frequently noticed at operations on the mastoid, especially in the radical operation when the mucous membrane of the middle ear is freely curetted.

*The Eustachian Tube as a Transmitter of Sound.*—The tuning fork held in the open mouth is heard more distinctly in normal ears than when in front of the nostrils or the closed mouth, but not as distinctly as when held near the ear. Nor is the hearing of a fork held in the mouth increased when the external ears are held closed. A tuning fork held in front of the nostrils is not heard longer than when held at the back of the head.

The fact that a tuning fork held in the open mouth is heard longer and louder than when it is held in front of normally patent nostrils, does not indicate that sound waves travel through the tube more readily by this route, but that sonorous impressions are thus more directly transmitted to the bones of the head and their enclosed air spaces, and are thus by direct vibration transferred to the hearing organ.

A curious instance of voluntary deflation of the middle ear occurred in the case of a physician recently treated, who had normal hearing. In childhood he found that he was able to diminish the intensity of loud sounds which were disagreeable to him, by a voluntary act performed thus: The act of yawning was simulated, but without opening the mouth. Then an indrawing of the breath resulted in a rarefaction of the intra-tympanic atmosphere, causing the drum membrane to be drawn against the inner wall of the cavity, with resulting diminution of all auditory perceptions. In order to restore the hearing to normal the act was varied by contraction of the tensor muscles as before and by then autoinflating the tubes.

*Symptomatology.*—In early inflammations of the tubes with beginning obstruction, also, after the subsidence of more pronounced obstructions, and in many chronic forms of ear diseases as well, the symptom of the occurrence of a snapping sound in the ears on swallowing or on blowing the nose, is present. The presence of this symptom always means a definite condition, and is a certain indication of partial tubal obstruction. It means that there is a partial obstruction of the tube, but one easily overcome. The mere contraction of the tensor and levator palati opens the tube sufficiently to restore wholly or partially to normal the atmosphere of the tympanic cavity. Though there may be some difference of opinion as to the exact cause of this snapping sound on swallowing, I believe it is chiefly due to the drawing apart of the walls of the

tube through a greater or less part of its length by the contraction of the tensor and levator palati muscles.

In severe phases of obstruction of the tube no snapping sound occurs on swallowing or on moderate blowing of the nose. Severe blowing, autoinflation, Politzerization or catheterization may, however, momentarily restore the atmospheric balance. In the most severe forms of obstruction, all these fail. Astringents applied to the pharyngeal mouths of the tube may aid in restoring the balance.

On investigating this phase of middle-ear disease, I have been surprised, though it may not surprise others, to find how common is the occurrence of the loud, snapping sound referred to, in one or both ears, in various forms of chronic middle-ear diseases, as in chronic catarrh and in the so-called mixed, middle and internal ear disease. I believe that inflammation of the tube alone may occur without involvement of the other parts of the ear as stated above; but, that more or less active inflammatory processes in the Eustachian tube co-exist with a large proportion of the non-suppurative ear diseases daily met with, may be inferred from the frequent presence of symptoms referable to the tubes themselves. The following symptoms are more or less significant:

*Snapping.*—A swelling of moderate or severe degree of the mucous membrane lining the tube impedes the passage of air into the tympanic cavity, where an apparently rapid absorption of air into the circulation is constantly occurring. Very mild degrees of obstruction are relieved by swallowing or pushing forward the lower jaw. When this occurs, a sound, similar to that of the separation of the moistened finger and thumb, held in front of the meatus, is perceived. This snapping sound made by the opening of the tube is heard more intensely when the swollen walls of the tube separate on blowing the nose or on autoinflation. In nearly all acute forms of ear diseases this symptom is more or less prominent, and it also commonly accompanies exacerbations of chronic middle-ear inflammation. It is an accompaniment of involvements of the tube in acute rhinitis and pharyngitis. Its presence in middle-ear catarrh and sclerosis is taken by the writer as a sign of a continuing degeneration of the middle-ear region, the cause of which should be sought for in the nose, pharynx or tonsils as well as in the tubes. It is a symptom frequently ignored by the pa-



tient, especially in chronic cases, and must nearly always be inquired for, in order to determine its presence or absence. It is never present in normal tubes nor in abnormally patent tubes. It is not a prominent symptom in very markedly obstructed tubes and cannot occur in absolute closure of the tubes. It appears to be common in pharyngitis, with or without involvement of more than the pharyngeal mouths of the Eustachian tubes. It is hence a frequent precursor as well as an accompanying symptom of various diseases, though it has been observed to occur at intervals for a long time without the accompaniment of noticeable impairment of hearing. On the appearance of the latter symptom, the occurrence of snapping sounds in cases of gradually progressive ear disease may cease or may become less frequent, or the patient may be so used to it that it is rarely complained of.

This symptom of tubal obstruction (snapping) may continue or recur at intervals in all forms of non-suppurative middle-ear diseases. Its irregular recurrence may indicate that these periods of obstruction of the tubes are partially or wholly responsible for the irregular course of the degenerative changes taking place in the ear.

*Paracusis.*—A symptom often complained of in Eustachian obstruction, though I believe not pathognomonic, is a sense of fullness in the ears, with more or less impairment of hearing (the latter may be absent) and a sound-sensation in speaking as if talking in a hollow space or into a barrel. Vertigo, usually slight, sometimes quite severe, may accompany this symptom. I am in the habit of associating these with a considerable degree of swelling of the tubal membrane. They disappear when due to tubal obstruction, on the disappearance of the acute symptoms of the latter. Recurrence may take place with each attack of acute inflammation in nose, pharynx and tubes.

*Pain.*—Pain due to tubal inflammation is rarely present without inflammation of the tympanic cavity, and I think can rarely be demonstrated as referable to the tube alone.

Pain in the Eustachian tube, however, is rarely located by patients. The discomfort of passing the Eustachian bougie is usually referred by the patient either to the ear or to the side of the throat. The objective symptoms may be slight or absent; though, if the obstruction is pronounced the retraction of the membrana tympani is very noticeable.



*Itching.*—Two cases in which a sensation of itching seems clearly referable to tubal congestion are briefly reported.

1. Philip Kelly, twenty-five years old, has had impairment of hearing and tinnitus for three months following a "cold." At first he had a great deal of snapping in his ears on swallowing or blowing the nose. Watch, Right 1-60; left 1-120. An itching sensation felt in the throat. He has tried to relieve this by scraping it as far inside the back of the throat as he could reach with his finger nail. Extreme retraction of the drum membrane, slight congestion of vessels of drum.

2. Henry Mollow, twenty years of age, has had severe tinnitus for one week in both ears, following a salt-water bath. On the fourth day he had slight pain in the ear, but no disturbance of sleep. Previously there was snapping in the ears. At present he has a sensation of fullness in the ears. Tinnitus is noticeable in both ears and an itching apparently deep in the ears. The drum shows retraction and slight congestion of hammer vessels.

A sensation described as itching or "crawling" in the ears or tube is sometimes a symptom of tubal obstruction. Thus, a lady of forty years (Everdell, July 31, '05), who complained that she had at times a sensation in the ears as though there was something crawling in her ear, obtained relief for a time after each autoinflation.

The tympanic cavity, however, does not long maintain its integrity after the occurrence of pronounced obstruction of the tube, and a reddening of the membrana tympani soon occurs.

*Tinnitus.*—Diseases of the nasopharynx and Eustachian tube are so admittedly cases of tinnitus that one accepts it axiomatically. That tinnitus is, frequently, directly referable to tubal congestion or inflammation, I think certain. It is a matter of observation that the inhaling of cigarette smoke may cause an immediate increase of tinnitus. An *initial* inhalation may cause this. As this may occur with the first inhalation and without swallowing or any act which would draw open the tube, it seems clear enough that the irritating effect of the smoke on the pharyngeal mouth of the tube is responsible for this. If irritation at the mouth of the tube may cause or increase tinnitus, it is proper to infer that irritation, congestion or inflammation of the deeper part of the tube may cause tinnitus. This is not a mooted point, but I have frequently found

it difficult to refer tinnitus definitely to this region rather than in another part of the ear.

The symptom of a snapping sound heard by persons with moderate degree of obstruction of the tube on swallowing, blowing the nose, protruding the lower jaw and certain other methods of contracting the tensor and levator palati muscles, is of importance in indicating a continuing of the tubal trouble even after the existence of middle and internal ear disease of many years' standing. How much influence these continued or recurring obstructions of the tubes bear upon the progress of the trouble I am not prepared to say, but I believe it worth while to ascertain the presence or absence of this symptom, not only because its presence indicates the need of treatment of the tube, but also in that it indicates a moderate degree of obstruction, rather tending to a favorable prognosis, other conditions being equal.

When snapping sounds are absent, I believe it indicates that there is no obstruction, as in some sclerotic or atrophic changes, or that the tube is so much obstructed that air is conducted to the tympanic cavity only with great difficulty. Further examination and tests easily reveal which of the two conditions is present.

The following table shows the considerable proportion of non-suppurative ear diseases in which the above symptom was found in a series of cases from a clinic in January:

Sex.	Age.	Disease and its duration.	Absence or presence of snapping sounds.	Remarks.
Male	69	o. m. c. c. 10 yrs.	Affirmative	Noticed at intervals only; more noticeable before treatment was begun.
Male	27	o. m. c. c. 5 yrs.	?	Mucus evacuated from tube on catheterizing.
Female	25	o. m. p. resid. 4 to 6 yrs.	Negative	Chronic pharyngitis present.
Female	65	o. m. c. c. 20 yrs.	Affirmative	Noticed on coughing as well on blowing the nose.

Sex.	Age.	Disease and its duration.	Absence or presence of snapping sounds.	Remarks.
Female	—	o. m. c. c. 5 yrs.	Affirmative	Snapping also occurs without effort on part of patient.
Male	26	o. m. c. c.	Negative	
Female	50	o. m. c. c.	Negative	
Female	40	o. m. p. resid.	Affirmative	Vertigo at times.
Female	29	o. m. c. c.	Negative	
Female	19	o. m. c. c.	Negative	Snapping occurred previously i. e. before treatment was instituted.
Male	49	ot. med. et int.	Negative	
Female	6	Day after recovery from o. m. p. a.	Negative	No sound noted on Politzerization.
Male	59	ot. med. et int.	Affirmative	
Female	39	Recovered from mastoid op.	Affirmative	
Male	40	Tubal catarrh	Affirmative	States snapping is almost continuous. Is a cigar-maker.
Female	20	o. m. scl. 5 yrs.	Affirmative	At times not noticeable.
Male	43	o. m. c. c.	Affirmative	
Male	52	ot. med. et int.	?	Formerly much snapping. At present none; but hearing is worse than when snapping occurred.

The evidence of the presence of tubal obstruction in chronic middle-ear diseases indicates a need for the treatment of this important complication. It may be possible to do little or nothing for the middle-ear diseases other than that affecting the tube alone, which as a rule is tractable. Treatment directed to the relief of tubal obstruction alone, has a positive effect in preventing or checking the progress of diseases affecting other portions of the sound conducting apparatus.

## IX.

### PARTIAL BIBLIOGRAPHY OF RECENT PAPERS RELATING TO THE EUSTACHIAN TUBE.

BY WILLIAM C. BRAISLIN, M. D.,

BROOKLYN.

In the preparation of this list the reports on the progress of otology in the *Archives of Otology* have been freely utilized. This has enabled the writer to include several important papers in the list, the originals of which would not have been readily accessible, though in nearly all instances the references have been verified by direct examination of the papers themselves. In most cases of articles not written in English the titles are given in translation.

ALLEN, HARRISON, On a New Method of Recording the Motions of the Soft Palate. Trans. of the Coll. of Physicians of Philadelphia, 3rd Series, Vol. VII, 1884, pp. 164-194. Allen observes that motions of the soft palate are transmitted to a rod passed along the floor of the nose into the pharynx, and, by means of a mechanism, these motions are recorded on a revolving cylinder in much the same way that the heart impulses are similarly recorded. It furnishes a positive basis of record of the motions of the soft palate. Tracings of various consonant and vowel sounds are figured and the method. Allen suggests its usefulness in paralysis of the palate, also possibly in stammering and in determining the degree of degeneration of the levator palati muscles in progressive dry catarrh.

BACON, GORHAM, The Anatomy, Physiology and Diseases of the Eustachian Tube. Reference Hand-book of the Medical Sciences, Vol. II, N. Y., 1886.

BALLENGER, WM. L., Tenotomy of the Tensor Tympani Muscle for the Relief of Deafness and Tinnitus. Laryngoscope VIII, 1900, pp. 85-89. The causes, indications for operative interference and contraindications for same are described.



- BARATOUX, J., De l'électrolyse ou de la galvanocaustique chimique de la trompe d'Eustache. *Revue Mens. de Laryng.*, 1884, No. 6, pp. 185-194 (On electrolysis or chemical galvanic cautery treatment of the Eustachian tube). Baratoux refers to previous attempts at the employment of electrolysis for obstructions of the tubes. He used a hard rubber catheter, at its enlarged end a hole, through which an electrode of silver or platinum is introduced. The second electrode is placed on the mastoid process. The current is used not stronger than five milliamperemeters nor longer than five minutes.
- BERNOUD, The Treatment of Deafness with Insufflations of Hot Air. *Wiener med. Blätter*, XXVI, No. 39, 1904, pp. 475-477. The apparatus of Beck is used. The temperature of the air is regulated by an electrical heater. Bernoud states that tinnitus disappears and a slight improvement in the hearing occurs from its use.
- BEZOLD, FRIEDRICH, A Case of Perforating Wound of the Organs of Hearing, in Court, and Subsequent Indictment of the Plaintiff for Supposed Simulation and Perjury. *Berliner klin. Wochenschrift*, XX, No. 40, 1883, pp. 611-614. An individual received a shot wound of the left ear and brought suit against his assailant. This case was finally referred to Bezold for an expert opinion. He found that the injury (a knife cut inflicted by the defendant with a sharp-pointed knife in the neck) had penetrated the lumen of the tube, causing a complete obstruction. A whalebone bougie met the obstruction 14 mm. within the mouth of the tube.
- BEZOLD, F., Cholesteatoma, Perforation of Shrapnell's Membrane, and Occlusion of the Tube. An Etiological Study. Translation by Dr. J. A. Spalding, *Archives of Otology*, XIX, 1890, pp. 232-254. A case was observed, post-mortem, of entire occlusion of the tympanic orifice, demonstrated, viz., a marginal adhesion of the entire periphery of a perforation of Mt. existed. When the tube was inflated the rest of the Mt. puffed out all about the tubal orifice.
- BLAKE, CLARENCE J., reviewing article by C. Nicoladoni, Beobachtung am Lebenden über die Bewegung der Tuba Eustachii, *Arch. Ophthalmology and Otology*, Vol. V,

1876, p. 122, states that he saw a case in which the normal Mt. was lacking and a thin cicatrix extended over the auditory canal. At the commencement of the act of swallowing, this cicatrix was forcibly extended, falling into place at the end of the act.

BLAU, L., Ein fall von kronischen Krampf des Musculus Tensor tympani ohne subjective Empfindung. Archiv. für Ohrenheilkunde, Bd. XIII, p. 261. A 14-year-old boy had sensation of pressure and temporary lancinating pains in his right ear, increased resonance of his own voice, many subjective auditory perceptions, normal hearing. Spasmodic rapid motions of the Mt. were observable; also changes in the cone of light or extreme retractions of the Mt. not connected with respiration. Author attributes these to contractions of tensor tympani muscle.

BONNIER, M. P., The Tubo-tympanic Functions. Note, presented by Girard. Compt. rend, des Séances de la Soc. de Biol., Nov. 26, 1892, Feb. 18, 1893, April 15, 1893. "Descriptions of the manner in which the Eustachian tube, the tympanum, otoliths and otocysts assist in the functions of the apparatus of equilibrium."

BOULAI, Voluntary Contraction of the Muscles of the Tympanic Membrane. Arch. internat. de Laryngol, etc., XIII, 2, 1893. Two cases observed where a distinctly audible crackling noise occurred 30 times a minute. In one, the drum showed simultaneous vibrations. It could be produced voluntarily. Boulai considered it due to contractions of the tensor tympani.

BRAISLIN, WM. C., Eustachian Catarrh with Hyperinflation. Report of a case. Archives of Otology, XXXVII, 1908, pp. 215-216. Report of a case of extreme patency of the Eustachian tube, with an account of symptoms.

BRANDEGEE, WM. P., Tympanic Vertigo due to Obstruction within the Eustachian Tube. Arch. of Otology, XXX, 1901, pp. 205-213. The value of the electrolytic bougie is contended for. Over other forms of bougies Brandegee claims the advantages of ease of manipulation, a minimum of pain, a minimum amount of trauma, thorough destruction of the stricture or occlusion and that the force to be used should be only that sufficient to insure good contact for the current.

- BROICH, F., Method of Direct Vibratory Massage of the Eustachian Tube and Its Effect on the Middle Ear. Report Germ. Otol. Soc. Arch. of Otol., XXVIII, 1899, pp. 388-389. Special probes introduced by way of the nose afford a direct massage of the pharyngeal ostium and the commencement of the tubal canal, as produced by Spoes' saw-handle driven by the electro-magnet.
- BRUNNER, GUSTAV, On Alterations in the Hearing by One's Own Voice. Arch. Ophthal. and Otol., II. No. 1, 1870, pp. 107-126. Case of deafness (obstr. of tube) in which patient's own voice seems too loud in affected ear and very disagreeable. Inflation of air through the tube caused cessation of symptoms. Regarded symptoms as not due to exudation of fluid in middle ear.
- BRUNNER, G., On Vertigo Occurring in Affections of the Ear (Auditory Vertigo). Archives of Ophthalmology and Otology, II. No. 1, 1870, pp. 293-341. Vertigo may be occasioned by external pressure upon the drum-heads, by impulsions of air or liquids into the tympanic cavity through the Eustachian tubes or by the passage of a galvanic current through the ears. In injecting sulphate of zinc, one and one-half grains to the ounce, in right ear, his patient felt as if drawn to the direction of same side (right). [He says erroneously that the patient had a tendency to fall towards the right side. The patient makes an effort to overcome the apparent (to the patient) falling to the right and falls to the left side in such a case.]
- BRYANT, W. SOHIER, Demonstration of the Movements of the Eustachian Tube. Archives of Otology, XXXV, 1906, p. 564. (No details reported.)
- BRYANT, W. SOHIER, The Anatomy of the Child's Ear, Emphasizing Points of Practical Importance. Arch. of Otol., XXXIV, 1905, pp. 80-83. Bony portion of Eustachian tube absent at birth. Cribriform bone interposed between the floor of the tympanum and the carotid canal at the jugular fossa, which is below the tympanum, not behind. The mastoid is but slightly developed. The Eustachian tube is narrower and much shorter in the infant. It measures about 20 m. as against about 40 m. in the adult from the anterior border of the sulcus tympanicus. Its



lumen at the isthmus is 2 m. as against 4 m. in the adult. It lies in a horizontal plane. Its angle with the median plane is about  $45^{\circ}$  and outwards as in the adult. At puberty it assumes the adult position. The relative position of the pharyngeal mouth of the Eust. tube to the posterior pharyngeal wall and the velum palati is farther forward and slightly lower down. The fossa of Rosenmüller does not form a deep impression till later in life. At birth the cavity of the middle ear, being filled with myxomatous tissue and detritus, no air enters the tube immediately [but it is probable that the motion of the tensors produced by sucking, rapidly stimulates the opening of the tube].

BRYANT, W. SOHIER, *The Eustachian Tube, Its Anatomy and Its Movements; With a Description of the Cartilages, Muscles, Fasciae, and the Fossa of Rosenmüller.* Medical Record, LXXI., pp. 931-934, 1907. A detailed anatomical study of this region.

BUCK, A. H., *Unnatural Patency of the Eustachian Tube.* Am. Jour. of Otology, II., 1880, pp. 203-205. A case related.

BUERKNER, *Report on the Treatment of Affections of the Tube.* Report German Otol. Soc., 3rd meeting. Arch. of Otology, XXIV., 1895, pp. 59-62. Attention is called to the importance of catheterization when there is swelling in and mucous secretion of the tube, preferring it to Politzerization. The fear of causing infection of the middle ear in acute nasopharyngeal or tubal affections is an exaggerated one, the neglect to inflate the middle ear causing the most harm. Gargling is regarded as an important measure in all simple tubal affections. Injections through the catheter are useful but should not be irritating. The use of the bougie in the tube is only indicated when catheterization causes no improvement. Medications and the use of the bougie are seldom productive of good results, though the vibration massage, by means of the bougie, by Urbantschitsch's method, is sometimes indicated. This is often painful. Politzer's method of external massage, on the other hand, is not. In atresia of the tube electrolysis and excision of the drum membrane and malleus are measures for consideration. Abnormal



patulousness of the tube and abnormal conditions of the nose and nasopharynx (ulcerative processes, synechiae, adenoid vegetations and hypertrophy of the tube) are important in their bearing. Galvanocautery is not devoid of danger; acids are preferable. Discussion: Bezold agrees that the air douche should be used in acute affections of the tube. Catheterization is often preferable to Politzerization even in children. He has never found atresia of the tube in all his autopsies. The use of the bougie should be restricted. Bresgen recommends removal of nasal obstructions. Siebenmann does not consider nasal obstruction to have any etiologic significance in tubal disease. Apart from adenoids he has not found stenosis at autopsies. Barth and Fischenick believe nasal obstruction an etiological factor. Hartmann uses inflation as long as good results are obtained. He frequently uses injections. Cocain acts well. Removal of nasal tumor may often be dispensed with if thin, short-beaked catheters are used.

CALHOUN, A. W., Adenoid Vegetations, with Especial Reference to Their Influence Upon the Ear. *Laryngoscope* VI., 1899, pp. 164-168. "Direct pressure upon the mouth of the tube rarely occurs, and yet its function is so frequently interfered with that contraction or sinking of the drum-head follows. Perhaps the aural symptoms are due to the swelling of the mouth of the tube or an extension of the inflammatory process through the tube into the middle ear. Breathing through the mouth and the blocking of the postnasal space change the air currents and alter the pressure about the mouth of the tube." The growth hinders the free action of the muscles controlling the lumen of the tube and permitting the entrance of air into the middle ear. This condition causes defects of hearing. This process sooner or later ends in chronic catarrhal otitis media with ankylosis of the ossicles. A suppurative inflammation frequently results from the presence of the mass.

CAMERER, Foreign Body in the Eustachian Tube. *Archiv. für Ohrenheilk.*, XL, 1896, pp. 63-64; Tübingen, 1894, Abs. A six-year-old boy fell from a wagon fifteen months previously. A piece of straw was driven into the mouth

at the time but the visible portion was removed. One month later the right lateral pharyngeal region presented a swollen condition and otorrhea appeared in right ear. The latter continued a year with latterly aural hemorrhage. On the removal of offensive pus and granulations, roughened bone was detected and a movable body, which when removed proved to be a straw, 4 1-2 cm. by 2 mm.

CITELLI, S., On the Structure of the Human Eustachian Tube. *Archivio Italiano di otologia*, XVI., 1905, pp. 404-418, pp. 441-452. The histology of the tube is given in detail.

COLLET, On Salpingoscopy. *Lyon Médical*, 46, 1903, pp. 725-730. The Valentin salpingoscope is recommended.

DENCH, E. B., New Eustachian Bougie. *Archives of Otology*, XXI., 1892, pp. 149-156. A fine whalebone bougie is used. This is attached to the catheter by guides so that the lumen of the tube is not obstructed; at the same time the bougie may be passed into the tube at the same introduction as the catheter.

DENKER, The Eustachian Tube of the Ant-Eater. *Zeitschr. für Morphologie u. Anthropologie*, Bd. VIII., pp. 1-10. A paper regarding the comparative anatomy of *Myrmecophaga jubata* and *M. didactyla*.

DENKER, Investigations of the Eustachian Tube of the Ant-Eater. *Myrmecophaga didactyla* et *M. jubata*. *Trans. Ger. Otol. Soc.*, 1904. In the first, no true tube exists, for a broad cavity surrounded by membranous walls occupies the place of the tube. No bony tube. There is a round opening from the posterior and inferior corner of the tympanum to which the membranous canal is attached. In the latter species the large cavity is surrounded anteriorly by the tympanum and the pterygoid, posteriorly by a process of the basilar occipital.

DENNERT, H., Zur Physiologie der Tuba Eustachii Grund einer Beobachtung von doppelleitigen organischen Verschluss der Rachenmündung derselben. *Deutsche Zeitschrift für pract. Medicin*, No. 44, 1878. D. observed a patient with great syphilitic destruction of the nasopharyngeal space. Cicatrix closed off the mouths of the Eustachian tube. Hearing was impaired and tinnitus present. During the act of swallowing both (most in left)

Mt. were observed to sink in with subsequent outward motion. The same was observed when the nose was held during deglutition. D. thinks the phenomena due to a dilatation of the tube in the act of swallowing, producing a rarefaction of the enclosed air.

- DE ROSSI, Researches on the Microorganisms in the Eustachian Tube of Healthy Individuals. Trans. 9th Internat. Med. Cong., pp. 859-862, 1887, Washington. In the secretions of the Eustachian tubes of twelve healthy individuals examined, the presence of germs was determined in six. None were of a pathologic character.
- DE SIMONI, A., Intratympanic Injections in the Treatment of Chronic Middle Ear Catarrh. Arch. ital. di otologia, VII, p. 81. States good results followed use of vaseline oil and iodoform-ether through Eustachian tubes.
- DUEL, ARTHUR B., The Possibilities and Limitations of the Electrolytic Bougie in the Treatment of Chronic Catarrhal Otitis. Laryngoscope, XIII, 1903, pp. 523-532. Duel thinks this method pre-eminent as a method of restoring patency of the tube. Best results are obtained by employing it sparingly and in connection with other forms of treatment. Intervals of two weeks should elapse before repetition. Caution is advised against using too often, too strong, and too hurriedly. Small bougies, small current, time and patience are advised.
- DUEL, A. B., The Rapid Dilation of the Eustachian Tube by Electrolysis. Laryngoscope, III, 1897, pp. 31-37. The electrolytic action of the negative pole of the galvanic current is employed. It is applied by one of four copper bougies, Nos. 3 to 6 French, mounted on No. 5 piano wire. They are passed through insulated silver catheters.
- DUEL, A. B., An Additional Note on the Treatment of Strictures of the Eustachian Tube by Electrolysis. Laryngoscope, IV, 1898, pp. 116-119. Duel repeats that this treatment is not recommended for sclerosis, but only for narrowing of the tube. 20 to 40 volts are required of 2 to 5 amperes. The operator should satisfy himself that the catheter is in place by the rhinoscopic mirror, or by successful inflation before the introduction of the gold bougie. The silver catheter is insulated by rubber dressing. The bougie should be pushed past the constriction slowly, occu-



pying two minutes or more. The bougieing should not be repeated before a week or more, but inflations should be continued. Many cases seem to be cured by one bougieing.

DUEL, A. B., The Value of Electrolytic Dilatation of the Eustachian Tubes in Chronic Tubal Catarrh and Chronic Otitis Media. *Amer. Jour. Med. Sciences*, April, 1900. Many of the 50 reported cases were relieved or much improved as to the vertigo and tinnitus by restoration of the patency of the tubes. In nearly one-half the impairment of hearing was improved. The bougies are made of solid gold 2, 3 and 4 French scale. They should fit the tube snugly. The bougie is attached to the negative pole; the positive pole held in the patient's hand. Obstructions in the tube are overcome by using from 1 to 3 amperes of the current. After 20 seconds the bougie may be further introduced. It is not employed for more than five minutes at one time, and repeated at intervals of one week to one month, inflations being practiced every other day. Two to four sittings are usually sufficient. A battery of 30 to 50 volts is employed.

EITELBERG, VON A., Bougieing the Eustachian Tube. Tr. by Dr. Cornelius Williams. *Archives of Otology*, XIII, 1884, pp. 168-182. Eitelberg ascertained the average length of the Eustachian tube in adults as 36 to 44 mm. In the newly born the average is 19 mm. Eitelberg found that the penetration of the catheter amounted to from 6 to 11 mm. The longest tube measured among 15 fresh specimens was 48 mm.; the isthmus tubæ in this case was 28 mm. from the tubal orifice (pharyngeal end). The average distance from the ostium pharyngeum to the isthmus is 24 mm. The normal width of the isthmus is  $1\frac{1}{2}$  to 2 mm. In a case of chronic suppuration a bougie of large size (No. 4 Charrière) freely entered both tubes and could be made to present in the auditory canals. The average length of the Eustachian tube as measured on the living patients was about 35 mm. Stricture of the middle part of the tube is exceedingly rare. In three cases Eitelberg succeeded in passing a bougie of larger size further into the tube than the smaller bougie would penetrate. He thinks this is due to the smaller tube being more read-



ily engaged by folds of mucous membrane; also rotation on its long axis of a larger bougie more readily releases it. The infantile tube is both relatively and absolutely wider than the adult at its narrowest part, according to this author.

ESCHWEILER, On the Development of the Sound-Conducting Apparatus, with a Special Regard to the Tensor Tympani Muscle. *Arch. für micr. Anat.* XLIII, pp. 150-196.

FISCHENICK, FR., The Treatment of Catarrhal Adhesive Processes in the Middle Ear with Intratubal Pilocarpine Injections. *Berlin. klin. Wochenschr.*, Vol. 37, 1900, pp. 1033-1034. Fischenick regards intratubal injections useful in sclerosis. Six to eighteen drops of a two per cent. solution are injected into each tube. Thirty to sixty sittings are given.

FERGUSON, H. LINDO, An Improved Form of Eustachian Catheter. *Archives of Otology*, XIII, 1884, p. 296. A flexible tube bent to the proper curve is used. Into this is passed a straight stylet. It is used where obstructions forbidding the use of the ordinary catheter are met with. On passing the obstructions the style is withdrawn, whereupon the catheter assumes its proper shape.

FOURNIÉ, EDW., Du Role physiologique de la trompe d'Eustache. *Congrès periodique internat. d'otologie*, 2d. Milan, 1880, pp. 119-126.

GOLDSTEIN, M. A., The Use and Abuse of the Eustachian Bougie. *Laryngoscope*, XIII, 1903, pp. 515-522. Goldstein regards them of value in all chronic middle ear affections. Counter-indicated when patient complains of "fullness" after use or when hearing is dulled by them.

GOMPERZ, Typical Alterations of the Tension of the Membrana Tympani in Valvular Occlusions of the Eustachian Tubes. Rept. 1st meeting, Aust. Otol. Congress. *Wiener klin. Woch.*, IX, 1896, pp. 843-846. Bulgings of the postero-superior portion of the Mt. occur in otherwise normal Mt. and T. cavity. Symptoms occurring are sensations of pressure, tension, slight subjective noises and occasional deafness. With use of Siegle's otoscope the postero-sup. quadrant follows its compressions or rarefactions, but immediately jerks into its former bulged position. The most precautionous blowing of the nose produces

a feeling of air striking the Mt. Therefore no impediment to the entrance of air exists, but one to its exit. In Gomperz's cases catarrh of the nasopharynx, hypertrophy of the mucous membrane, polypi or suppuration of the accessory cavities were found.

GRADENIGO, G., Diagnosis, Prognosis and Treatment of Progressive Deafness in Chronic Non-Suppurative Inflammation of the Middle Ear. Trans. by J. A. Spalding, Arch. Otol. XX, 1891, pp. 221-227. The contents of the tube were examined to ascertain the presence or absence of bacterial life in this disorder. The examination was negative, the only species of bacteria found were a few individuals of the bacteria of putrefaction commonly found in the air. (The same observations, elaborated, occur Centralbl. f. Bacteriol. und Parasitenkunde, VIII, 1890, p. 225.

GRADLE, H., On Headache from Overlooked Causes in the Nasopharynx and Ears. Jour. Am. Med. Assn., Vol. XI, Sept. 8, 1888, pp. 339-340. Gradle considers a certain type of continual headache, more commonly met in children, due to impaired patency of the Eustachian tubes.

GRUBER, J., On the Therapeutic Value of Injections of Medicated Solutions into the Eustachian Tube. Monatschrift für Ohrenheil, XIV, 1880, pp. 133-139. Solutions injected into the Eustachian tube soften, but do not dissolve mucus, so that it can then be more readily removed by catheter. They also benefit, by producing a new inflammation, in certain conditions. Gruber believes that injections detach synechiae extending from drum to tympanic walls or to ossicles, even when air douche has not benefited.

HAIKE, H., Tuberculosis Ear Disease in Nurslings. Deutsche med. Wochenschr., Vol. XXXI, 1905, pp. 954-957. In five fatal cases the duration of the lesion was several weeks or months. In two cases, the possibility of the infective sputum entering through the Eustachian tubes could not be excluded. In the others the ear lesion was primary. The port of entry was the mouth or pharynx. Moreover, the author states, the tube itself may be the seat of disease in nurslings, while in adults it is merely the path of tubercular sputum.

HAMMERSCHLAG, V., Respiratory and Pulsatory Movements of the Drum Membrane. 1st Austrian Otol. Cong. Report, in Arch. of Otol., XXV, 1895, pp. 408-409. The investigations were made with an instrument similar to that of Mach, upon four healthy young individuals, in 30 observations. He found the Mt. exhibits constant movements, coincident with the systole of the heart.

HAMMERSCHLAG, V., On the Function of the Eustachian Tube. Arch. für Ohrenheilk, XLIII., 1897, p. 65 (a reply to Lucae's article in Arch. f. O.). He believes the middle ear and nasopharynx are in open communication. [Hartman, in Arch. of Otol., XXVII, 1898, pp. 179-80, again shows the fallacy of this belief in a review of the article. During inspiration alone no equalization of pressure ordinarily occurs, but on deglutition equalization is restored. B.]

HAMMERSCHLAG, V., On the Reflex Movements of the Tensor Tympani and Its Central Paths. Sitzungber. der Wien Akad. Math-naturh., Bd. CVIII, 3, p. 1. The contraction of the tensor in dogs, is believed by Hammerschlag to be a reflex, passing through the auditory nerve and originating in sound waves. In addition to the tract between the eighth and the fifth nuclei of the same side there is one between the eighth nerve nucleus of the one and the fifth motor nucleus of the other. Contractions of the tensor tympani occur after removal of the entire brain cortex, hence is a pure reflex process.

HARTMANN, A., Function der Tuba Eustachii. Archiv. f. Anat. und Physiologie, 1874. Experiments regarding the amount of pressure necessary to inject air through the tubes under varying conditions. While the muscles were in a state of rest air entered at a pressure of 20 to 40 mm. column of mercury. During the act of swallowing, 20 mm. or less was sufficient. In only one of the individuals who submitted himself to the experiments, the Eustachian tubes were open in a state of rest and the membrana tympani were pressed outward at a pressure of 10 mm. of mercury.

HARTMANN, A., Mittheilung über die Function der Tuba Eustachii. Archiv. für Anatomie und Physiologie, 1877, pp. 543-548. Hartmann concludes that the act of swal-



lowing draws tense the membranous walls of the tube, transforming this previously flaccid canal into a rigid one, that the tube remains closed as long as the muscles of the soft palate are at rest. He states that the weight of 200 mm. of mercury by manometric measurement is incapable of causing air to enter the tube while the muscles are uncontracted; and he believes that the membranous wall is but pressed the more firmly against the cartilaginous anterior wall of the tube; but that this valvular action is overcome by swallowing. From within the middle ear, air readily escapes from the pharyngeal orifice of the tube, as is proved by the escape of air bubbles when a person in the penumatic cabinet is subjected to only slight rarefaction of atmospheric pressure.

HARTMANN, A., *Experimentelle Studien ueber die Function der eustachischen Röhre*. Leipsic, 1879. Hartmann states that great condensation of the air in the nasopharynx opposes the opening of the tube, even during deglutition, by reason of the air pressure acting to force the membranous part of the tube against the cartilaginous roof. He proves that during respiration no interchange of air occurs between the tympanic cavity and pharynx in normal tubes. If abnormally patent there is an interchange, noticeable in a visible vibration of the Mt. coincident with respiration. Phonation may facilitate the passage of air, but does not do it so completely as deglutition. He accepts Zaufal's view that the act of deglutition moves the medial cartilaginous plate of the tube backward and medially. Thus the floor of the mouth of the tube expands by the separation of the lateral walls from each other. Simultaneously the prominence of the levator advances toward the orifice of the tube, which is thereby narrowed from above, downward, and from behind, forward. The sound-conducting power of the tube is but slightly discussed.

HARTMANN, A., *Ueber die Bestimmung der Durchgängigkeit der eustachischen Röhre mit Hilfe des Quicksilbermanometers*, Virchow's Archives, Bd. LXXIV, 1878, pp. 420-424. A repetition of the views expressed in his monograph on same subject.

HAUG, R., *Foreign Body in the Tubular Region After a Pre-*



vious Radical Operation. Tonsillar Abscess. Arch. f. Ohrenh., LVII, p. 45. A cotton pledget was lost in the depths of the auditory canal during the performance of a radical mastoid operation. An abscess of the peritonsillar tissue later appeared and on its evacuation the cotton pledget appeared. It was supposed to have reached its location through the levator muscle.

HEFLEBOWER, R. C., Clonic Spasm of the Tensor Tympani, N. Y. Med. Jour., LXI, 1895, pp. 325-328. A clicking noise, accompanied by twitching of throat muscles, was complained of. A perceptible indrawing of the central and lower part of Mt. was visible at time of each click.

HOLINGER, J., Spongifying of the Labyrinth. Laryngoscope, XI, 1901, pp. 31-35. An attempt is made by Holinger to differentiate between the diseases named and Eustachian obstruction. In Eustachian obstruction he gives predominant symptoms as: (a.) Retraction of the Mt., often extreme. (b.) Nose is affected by hypertrophies and subject to frequent colds. Pharynx is always examined with mirror and palate hook. (c.) Hearing distance increases after catheterization. Smokers' catarrh and stomach disorders affect the disease. In spongification of the labyrinth we have: (a.) Usually a history of deafness in family. (b.) The onset rarely begins before the age of 18 to 24. (c.) Sudden increase of deafness with heavy cannon shot noises. (d.) Mt. normal or nearly so. Nose, normal as a rule. Finally in the latter we have negative Rinne test, increased bone conduction for the lower sounds and a defect in hearing ability, mostly at the lower limits of the normal range.

HOPKINS, AGNES, On the Relative Dimensions of the Osseous Semicircular Canals of Birds. Biological Bulletin, Vol. XI, 1906, pp. 253-263. "The Eustachian tubes of birds have a common esophageal opening in all cases, except in the genera *Struthio*, *Eudytes*, and *Tinamus*, where there is a pair of apertures. The Eustachian tube is a perfect bony tube in the following: *Sterna*, *Squatarola*, *Ceryle*, *Psittacus*, *Geococcyx*, *Tetraonidae*, *Phasianidae*, *Catharista*, *Falco*, *Eudytes* and *Tinamus*. In all other cases it is imperfectly ossified."

HOPKINS, FRANK T., Electrolysis in the Treatment of Chronic

Eustachian Stenosis. Archives of Otolaryngology, XXXIV, 1905, pp. 495-501. Hopkins begins with a No. 1 bougie (French) and at intervals of from two to four weeks, repeated until at the expiration of several months the next size may be easily introduced. In the same way proceed to the use of Nos. 3 and 4, or even 5. Between the times of using the bougies, inflation with vapor or air is used. In the discussion (*ibid.*, pp. 539-546) members gave varying opinions regarding the usefulness of the electric bougie. Some had found the bone bougie equally good or better than the electrolysis. Several cases in which the tip of the gold bougie had broken off in the tube, where they still remained, without the patient being apparently worse than before, were reported.

HOVELL, T. MARK, Catheterization of the Eustachian Tubes. Brit. Med. Jour., Oct. 22, 1898, p. 1238. The author here proposes (1) that the gauge of the Eustachian catheter be that of the French catheter gauge; (2) that the length of the curve of the instrument be expressed in millimeters, the number indicating the distance the curve separates two parallel lines.

HOVELL, T. MARK, Catheterization of the Eustachian Tubes. Archives of Otol., XXVIII, 1899, pp. 51-52. The need of a uniformity of scale in the measurements of Eustachian catheter is stated.

HUBBARD, THOMAS, An Apparatus of Precision for Inflating and Medicating the Tympanum. Archives of Otol., XXII, 1893, pp. 27-32. An instrument is described by which sterile air is used for politzerization or inflation of the Eustachian tubes.

JACOBI, A., Otitis Media in Children. Arch of Otol., XXXIV, 1905, pp. 90-101. Pyogenic microbes enter the middle ear chiefly by way of the Eustachian tube, which R. O. Newman finds, even normally, contains microbes. They enter especially when coughing, sneezing or vomiting. Mainly so when the nares are obstructed by swelling, by a membrane or by congenital occlusion. The vibrating epithelium of the tube becomes paralyzed in conditions of ill-nutrition, colds and atrophy. In the young, the Eustachian tube is shorter but wider both at the isthmus and at the tympanic orifice and the direction of the canal is almost horizontal.

JOACHIM, OTTO, Contribution to the Physiology of the Soft Palate, Archives of Otology, XVIII, 1889, pp. 226-234. The entire nose was destroyed by syphilis in a case of the writer's, giving easy view of the entire pharynx and mouths of the Eustachian tubes. The orifice of the left tube was impervious and occluded with a considerably reduced power of hearing on this side. The effect of various articulated sounds on the motions of the soft palate and Eustachian orifice was carefully studied by the author.

KAYSER, R., Contribution to the Pathology and Treatment of Objective Ear Noises which, according to their Mode of Development, are divided into Tubal and Real Ear Noises. Trans. German Otol. Soc., 4th meeting, 1895. Arch. of Otol., XXIV, 1895, pp. 328-329. "The tubal noises are either muscular or elsewhere developed, as in autophonia, but transferred by changes to the tube. He considers the first form allied to chorea and hysteria, caused by contraction of the tensor veli palati. He uses for treatment an irritation by pressing either the velum palati, mastoid process or the teeth, but with varying success. If the snapping noise is produced by the separation of the tubal walls, a probe is introduced with immediate good results which persisted in but three cases." A discussion on the possibility of hearing the noises produced by the contraction of the tensor tympani arose, but the views were discordant.

KENEFICK, JOSEPH H., Electrolysis in the Destruction of Organized Strictures of the Eustachian Tube. Archives of Otology, XXX, 1901, pp. 73-84. Kenefick concludes: (1) That it cannot be foretold in any given case just what result will follow this treatment, as this will depend largely on two comparatively unknown quantities, viz., (a) the vascularity of the tube lining and its toleration of the electrical interference, and (b) on the degree of tympanic involvement. (2) That tubal obstruction is present early in the great majority of cases of so-called hypertrophic catarrhal otitis media and that their mechanical obstructions may be removed at an early stage of middle-ear involvement with excellent results. (3) That the best means of reabsorption of an organized obstruction of the Eustachian tube is by the electrolytic bougie.



- KERRISON, PHILIP D., Tinnitus Aurium. Kerrison classifies the various sources of tinnitus as due to: (1) Conduction sounds. (2) Blood sounds. (3) Labyrinthine sounds—alteration of intralabyrinthine pressures. (4) Neurotic sounds—increased irritability of the nerve. (5) Cerebral sounds—lesions of the cerebral cortex.
- KIRCHNER, W., On Formation of Diverticles in the Eustachian Tube, in Man. Pt. I, from Festschrift für A. Koelliker, Leipsic, 1887. A specimen of an Eustachian tube was shown, presenting a diverticle, lined with thin, firm membrane. It was situated about 1.5 mm. from the pharyngeal opening, about the size and form of a small bean 7 mm. in diameter and 6 mm. deep and opening by a sinus into the Eustachian tube. The tube itself was unchanged in length or diameter, and the lining mucous membrane presented no considerable change. The author is unable to conclude whether the malformation was congenital or the result of morbid action.
- KOENIG, On Passing Bougies in the Tubes. Trans. Seventh Int. Otol. Congress in Arch. of Otol., XXXIV, 1905, p. 348. Uses a combination catheter and bougie, the latter introduced into a small channel which opens into the caliber of the catheter. With a simultaneous application of the air-douche, performed by the patient with a double bag, the introduction of the bougie is performed more easily. A different catheter is used for each side.
- KOSTANECKI, CASIMIR VON, The Pharyngeal Ostium of the Eustachian Tube and its Relation to the Nasopharyngeal Cavity. Arch. f. mikrosk. Anat., XXIX, 1887, p. 539-592, pll. II. Some abnormal cases are related. Kostanecki observes that the pharyngeal tonsil may extend to the tuberosity of the Eustachian tube and even into its ostium.
- KYLE, D. BRADEN, The Position of the Orifice of the Eustachian Tube and the Possibility of Catheterizing it through the Mouth. Phil. Med. Journal, II, Sept. 24, 1898, pp. 622-626. A catheter for use through the mouth is made of coin silver, six inches in length and flexible. The patient depresses the tongue with a tongue depressor while the operator locates the tube with a mirror and introduces the catheter.



- KYLE, J. J., Natural Gas and Eustachian Inflammation. Jour. A. M. A., XXX, 1898, pp. 658-659. Natural gas, containing a large proportion of sulphuretted hydrogen, is regarded as most irritating to the nasal and tubal membrane.
- LAKE, RICHARD, Abnormal Course of the Chorda Tympani Through the Tympanic Cavity. Lancet, Jan. 5, 1895, p. 28. Exit at usual level, ran horizontally forward to lowest  $\frac{1}{4}$  of malleus handle, thence upwards, passing through canal of Huguier and keeping below the tensor tympani.
- LANCEREAU, Infection of Syphilis by Means of the Eustachian Catheter. Union Med., XLI, 1886, pp. 469-474.
- LARYNGOSCOPE, THE, Is the Eustachian tube open or closed during the Act of Deglutition? Laryngoscope, closed! Editorial, Laryngoscope, III, 1897, p. 190-191—a comment on Dr. Stillson's paper.
- LAVAL, Nasal Auscultation of the Ear During Catheterization. Archiv. für Ohrenh., LXVI, 1901, p. 120. By means of a hearing tube introduced high up in the opposite nostril, during catheterization, differential diagnosis is aimed at between the sounds heard at (a) the tubal ostium, (b) the tube, and (c) the tympanum. The latter are not heard by nasal auscultation, but only by aural. The sound of removing secretions from the tympanum through the tube is heard by nasal auscultation. Noises in Eustachian tube are heard equally by nasal and aural auscultation. The greatest amount of crepitant rale is produced by the escape of the exudate. The blowing noise is produced in the cartilaginous tube. Its character depends on the form of the tubal secretion. Rough blowing murmurs are produced by swelling and moisture in the mucous membrane of the tube.
- LERMOYEZ, M., and HELME, F., The Staphylococci of Otorrhea. Annales des mal. de l'oreille du nez et du phar., XXI, 1895, pp. 35-58. A discussion as to the appearances of microorganisms in ear diseases preceding or following acute inflammations in ear.
- LINHART, C. P., Rapid Dilatation of the Eustachian Tube. Columbus Med. Jour., XXV, 1901, pp. 345-351. Electrolysis is the method employed and recommended.
- LOCKARD, L. B., The Eustachian Bougie. N. Y. Med. Jour.,

Dec. 29, 1900, pp. 1127-1129. Reviews the indications for, and the advantages and disadvantages of, the instrument. It is recommended in two conditions only; stenosis and tinnitus.

LUCÆ, AUGUST, Zum Mechanismus des Gaumensegels und der Tuba Eustachii bei Normalhörenden. *Archiv. für path. Anat.*, Bd. LXXIV, 1878, pp. 238-245. Lucæ states that the mouth of the tube is compressed when the soft palate rises and is opened when it falls; hence, that a sort of pumping action of the tube is effected. He also believes it probable that an internal dilatation of the tube accompanies the external closure of the tube.

MARSHALL, GEO. M., What Can Be Accomplished by Treatment of the Eustachian Tube. *Jour. A. M. A.*, XXX, Mar. 19, 1898, p. 656. Bougies, smeared with nitrate of silver, 15 grains to an ounce of lanolin, are recommended for chronic stenosis of Eustachian tubes. They are left in place 20 to 30 minutes, not more than twice a week. Seven cases were greatly improved, five moderately, five no change.

MATLACK, E., Electrolysis in Eustachian Salpingitis with Stricture. Report of seventy-five cases. *American Medicine*, Vol. 5, Feb. 7, 1903, pp. 223-224. Electrolysis is regarded as of service in all forms of deafness (excluding pure labyrinthine conditions), and especially so in cases of moderate degree, where the greatest changes are located in the tube. More improvement resulted than by any other treatment, how permanently is not yet known.

McKERNON, JAMES, Distressing Tinnitus Relieved by Bougieing the Eustachian Tube. *Arch. of Otol.*, XXIX, 1900, pp. 394-395. The negative pole of a galvanic current was used in connection with a gold bougie, passed well into the tympanum. The current was 30 volts,  $3\frac{1}{2}$  milliamperes; contact,  $2\frac{1}{2}$  minutes. The tube was not strictured. Recovery was immediate and lasting.

MELZI, URBAN, On the Use of the Hard-Rubber Bougie in Chronic Affections of the Eustachian Tube and the Middle Ear. *Arch. Internat. de Laryngol. d'Otol. et de Rhinol.*, Vol. XV, 1902, pp. 81-87. Melzi cured three cases of O. M. C. C. by slow dilatation of the Eustachian tube by hard-rubber bougies.

- MCAULIFFE, GEO., Dilatation and Stenosis of the Eustachian Tube. New York Eye and Ear Infirmary Reports, Jan., 1898. Two cases, one of unusual dilatation and the other of stricture of the Eustachian tubes.
- MÉNIÈRE, E., The Use of Rubber Bougies in the Treatment of Chronic Catarrhal Affections of the Eustachian Tubes and the Middle Ear. Arch. Internat. de Laryng. d'Otol., etc., XI, 1898, pp. 31-36. Ménière assumes that catarrh of the Eustachian tube is the primary lesion which later causes middle ear changes. Uses bougies and recommends them. They are dipped in potassium iodide and iodine solution. He leaves them in place one-half minute to one hour. In two cases not improved by regular catheterizations, hearing was much improved.
- MÉNIÈRE, E., De la dilatation intermittente et progressive de la trompe d'Eustache. Franc. méd., I, 1889, pp. 445-448. (On the intermittent and progressive dilatation of Eustachian tube.) Ménière, after employing bougies for fifteen years, praises their use. Instead of withdrawing the tube he uses a method of his own; that is, he bends forward the patient's head, forcing it to slide out of itself.
- MÉNIÈRE, E., Catheterization of the Eustachian Tube (reply to discussion), Gaz. des Hôpitaux, Vol. 59, 1886, p. 268. Ménière uses only silver catheters, which he disinfects by keeping them in a vessel filled with alcohol. Before use, the catheter is exposed to an alcohol flame. It is then dipped in cold water and cleansed with a copper wire.
- MÉNIÈRE, E., On the use of Rubber Bougies in Chronic Catarrhal Affections of the Eustachian Tube and the Tympanum. Moscow International Conference, Arch. of Otol., XXVII, 1898, pp. 97, 98. "Chronic inflammation of the Eustachian tube is the most frequent cause of gradually progressive loss of hearing. In these cases, repeated insufflations of air often have no effect, though sometimes a marked improvement is produced by passing the bougies. The elastic bougies are the only serviceable ones; the end must be conical, and pass through a catheter of  $1\frac{1}{2}$ —2 mm. breadth. The following solution is used: Iodine pur., iodide of potash, each one grain, distilled water 13 grains. The bougie may remain in position 1 to 60 minutes. Irritation is slight; occasionally burning in the nasopharynx will be complained of."



MIOT, C. *Reflection sur l'obstruction de la trompe chez un diabetique.* (Remarks on the Obstruction of the Eustachian Tube in a Diabetic Patient. Société franc, d'otologie, April 15, 1887.) Miot states that cases of ear trouble in diabetics are caused by swelling of the Eustachian tube. They vary in deviation and intensity. Some are curable, in others the tube is permanently obstructed. Miot believes the constant current allays the congestion of the tube and renders possible the introduction of bougies (and the application of the galvanic cautery).

MICHEL, C., *Neue Beobachtung über das Verhalten der Rachenmündung der Tuba und über die Thätigkeit der Muskulatur des Schlundkopfes.* Berliner klin. Wochenschr., 1875, pp. 558-561. A patient, 20 years old, lost the entire nasal septum, permitting direct observation. On swallowing, the posterior surface of the soft palate came into view, pressing laterally between the cartilaginous projections of the Eustachian tubes and rising convexly against the posterior pharyngeal wall. Simultaneously the projections of the cartilages were elevated, their lower border approaching the median space of the pharynx; while, behind them, on the posterior pharyngeal wall appeared two projections rising from 1 to  $1\frac{1}{4}$  cm. above the surface of the palate and having a smooth surface 1 cm. wide between. On forcible deglutition this intermediate space disappeared and the mucous membrane presented additional folds. During phonation the appearance was much the same, except that a thick fold appeared on either side at the junction of the posterior and lateral pharyngeal walls. On sounding the vowel a, the palate was nearly flat; with e, i, o, u, it rose considerably above this level. The anterior border of the Eustachian opening remained nearly motionless, except that below it there appeared a slight fold, which was lost in the border of the palate, moving backward and forward during the act of swallowing. When at rest the Eustachian opening appeared like a furrow, the lower portion of which formed a triangle, the walls above lying in contact. The act of swallowing was accompanied by a wave-like motion on the floor of the orifice, then an elevation, the floor of the tube rising into the opening; and at the height of the act, the



moment of greatest elevation of the floor, the furrow opened, presenting the appearance of a dark triangle, the apex of which was lost in a black line extending upward. During phonation the cartilaginous projection of the tube moves backward, and its lower border is elevated by the upward pressure of the floor. The orifice opens only during the singing of the high i or e, as with these vowels the palate is forcibly elevated and the floor of the Eustachian opening pressed upward. On sounding these vowels both the cartilage projection and the velum vibrate forcibly, and the transmission of these vibrations to the osseous portion of the tube and to the ear may explain in great measure the singing sound heard on sounding and holding the high i. The cracking sound heard on swallowing may also be explained by the movement of the cartilage of the tube. [This conclusion, I believe, is erroneous. It is caused by the drawing apart of the lips of the mouth of the tube.]

MOLINIE, J., Defect of the Lips of the Eustachian Tube and Atresia of the Pharyngeal Tubal Ostium. Report of Trans. 7th Int. Otol. Cong. in Arch. of Otol., XXXIV, 1905, p. 327. (Also in Bull. de laryngol., otol. et rhinol., VII, 1904, p. 187.) Molinie saw two cases of contraction of the nasopharyngeal isthmus with atresia of tube. Both cases he thought due to too energetic use of galvanocaustic applications.

MOOS, S., Klinik der Ohrenkrankheiten, Wien, 1866. The folds in the lining mucous membrane of the Eustachian tube are most numerous at its lower portion and form a bulging just behind the pharyngeal orifice which aid in the closing of the tube.

MOOS, S., A Preliminary Notice on the Anatomy and Physiology of the Eustachian Tube. Arch. Ophthal. and Otol., I, 1869, pp. 716-717. Believes tube is closed while at rest by an intumescence at the pharyngeal orifice.

MOOS, S., The Histological Changes of the Eustachian Tube in Chronic Catarrh. (Trans. by Dr. A. N. Blodgett.) Arch. Ophthal. and Otol., V, 1876, pp. 542-560, pll. I and II. A case treated for Eustachian tube stenosis, at intervals for 10 years, came to autopsy. Normal and pathological anatomy of the tubes described.

Moos, S., Beiträge zur normalen und pathologischen Anatomie und zur Physiologie der eustachischen Röhre. Wiesbaden, 1874, p. 53, pl. VI. The tube when at rest is closed at a point just behind the funnel-shaped end of the faucial opening, and this closure extends through about two-fifths of the length of the canal. On the lower surface, or floor, of the tube the closure is effected by the longitudinal folds of mucous membrane, which form a considerable prominence, really a valve of variable size. On the opposite surface of the canal, below the cartilaginous hook, in the lower portion of the canal, is another prominence of mucous membrane smaller than the other. These have their analogy in the lower animals. They probably facilitate the patescence of the canal by their unrolling. The cartilaginous "islands" of the tube are divided into five classes, the most important being those on the floor and sides of the tube. Those on the sides consist always of fibrocartilage. They assume here the function of sesamoid bones in the tubal mechanism through their attachments.

MYLES, R. C., Adhesions Connecting the Eustachian Tube to the Pharyngeal Wall Above. Arch. of Otol., XXVI, 1897, pp. 322-323. Two cases reported in which there were adhesions connecting the Eustachian tube to the walls of the pharynx, forming a number of cavities (recesses?). The adhesions were torn with the finger with relief of symptoms.

NICOLADONI, C., Beobachtung am Lebenden über die Bewegung der Tuba Eustachii. Monatschr. für Ohrenheilk., Aug., 1875. A favorable opportunity for observing the movements of the Eustachian tube was presented by the performance of an operation on a tumor of the nasopharynx by first removing the upper jaw. "Simultaneously with the contact of the soft palate with the posterior pharyngeal wall, its posterior surface being almost in line with the floor of the nose the medial portion of the tube, about one millimetre in height, began its movement while the lateral portion appeared to remain at rest. The movement, rather rapidly performed, consisted in an elevation for about three millimetres of the lower prominent edge of the medial portion, which appeared to be

also drawn backward and slightly toward the median line. At the same time the lower boundary of the fossa of Rosenmüller became sharply marked and projected into the median space, an arcus salpingeus, the apex of the tube, remained at rest." A bubble formed of blood serum formed over the orifice of the tube. At each act of swallowing this bubble sank into the depth of the Eustachian tube to reappear immediately on the completion of the act.

PETER, The Eustachian Tubes and Their Appendages in the Mammalia. Arch. für microscop. Anat. XLIII, 1894, pp. 327-376.

PIERCE, NORVAL H., On the Value of Electrolysis in the Eustachian Tube. Arch. of Otol., XXXI, 1902, pp. 289-296. A good anatomical demonstration of the tube. The conclusions of the writer are that (1) in otosclerotic disease electrolysis is useless; (2) in the great majority of cases of catarrhal disease, it has no advantage over other methods of treatment; (3) in a certain few cases where there is probably a soft exudate near the isthmus, it may be regarded as of some value.

RANDALL, B. A., The Prime Effect upon the Ear of Nasal Stenosis. Phila. Polyclinic, IV, 1895, p. 173.

RANDALL, B. A., The Technic and Value of Catheter Inflation of the Tympanum. Phila. Polyclinic, VII, 1898, pp. 551-552. Randall expresses confidence in its use.

RANDALL, B. A., Clinical Anatomy of the Eustachian Tube. Laryngoscope, IX, 1900, p. 82. There is little variation in the topography of the surrounding parts. The back edge of the hard palate is practically unvarying. The lumen of the tube is a slit, usually collapsed and devoid of its "safety tube" at its inner third, while a valve-like fold in its bifurcated lower part serves with the drag of the relaxed palate, to insure its closure.

RANKE, H., Case of Malformation of the Ear. Sitzungsber d. Ges. f. Morphol. und Physiol. in Munich, No. 2, 1889, p. 68. The case examined postmortem revealed the meatus ending in a blind tube. The tympanic cavity was entirely absent. The Eustachian tube was rudimentary and ended blindly.

REITMANN, KARL, On the Structure of the Cartilage of the



Eustachian Tube in Man. Monats. für Ohrenheilk., XXXVIII, 1903, pp. 45-50. The cartilage of the Eustachian tube of the new-born is a typical reticular cartilage. In the adult the elastic fibers surround the cartilage cells. Occasionally there are vascular channels in the cartilage, which generally carry veins. The fatty degeneration of the cartilage, occasionally appearing, is regarded by the author as responsible for the fragmentation of the tubal cartilage."

DE ROALDES, A. W., Otological Peculiarities of the Negro. Rev. de Laryngol. et d' Otol., XV, 1895, pp. 1169-1182. Among other differences noted, the mouths of the Eustachian tubes are stated to be larger, the nasopharynx much more spacious, deafmutism rarer.

ROURE, M., On the Passage of Bougies in the Tubes in Cases of Dry Middle Ear Catarrh. Bull. de laryngol., otol., et rhinol., VII, 1904, p. 250. Uses a steel bougie and a modified catheter.

ROYET, Adhesions of the Eustachian Tube to the Posterior Pharyngeal Wall as a Cause for Progressive Sclerosing Otitis and Symptoms of Vertigo. Archiv. Internat. de Laryngol., d' Otol., et de Rhinol., XVII, 1904, pp. 371-397. The cause of progressing deafness is assigned by Royet to the broad adhesions of the pharyngeal opening of the Eustachian tube to the posterior pharyngeal wall. After division of these adhesions with the finger the author believes he has observed cases of recovery, improvement or at least a bar to its progress.

RUMBOLD, THOS. F., Functions of the Eustachian Tube. St. Louis Medical and Surgical Journal, July 20 to September 5, 1880.

RUMBOLD, THOS. F., Remarks on the Inflation of the Middle Ear. Laryngoscope, II, 1897, pp. 291-294. Rumbold believes two objects are accomplished by inflation with the Politzer bag: (1) removal of a plug of mucus from the tube of the middle ear cavity; (2) restoration of the normal atmospheric pressure of the middle ear.

SCHADE, Migration of a Nail from the Nasopharynx into the Middle Ear. Deutsche med. Wochenschr., XXVIII, 1902, p. 796. Four years previously the patient extracted a nail from a box with his teeth. He swallowed the nail



and suffered pain in his throat for some time. Attempts at extraction failed. Lately after a violent motion sudden pain occurred in the left ear, and in three days the patient was able to extract the nail out of the ear. It was 12 mm. long, 1 mm. thick and bent in the middle. [There seems to be no proof that the nail passed through the tube.—B.].

SCHWALBE, G., Text-book of the Anatomy of the Organs of Special Sense. 2nd part, 2nd half, Erlangen, 1886. Schwalbe agrees that the greater portion of the cartilaginous tube is closed in a state of rest. It represents a closed vertical fissure, which every now and then is opened either by the simultaneous action of the tensor and levator palati or by the tensor alone. The orifice may also be opened by the tensor alone, independently of the act of swallowing. The levator is (thus) presumed to act by virtue of the fact that the belly of the muscle is thickened, in the region of the tube, by its contraction, and so the walls are pressed apart. Contraction of the muscular fibers of the posterior-superior portions of the tube alone does not enlarge the orifice of the tube; this rather elongates the vertical fissure, smooths out the folds on the m. m. of the floor and thus fixes that portion of the tube wall.

SCHWABACH, D., On the Pathological Anatomy of Deaf-mutism. Arch. of Otology, XXXII, 1903, p. 378. The case described was that of a deafmute who died of acute miliary tuberculosis. The mucous membrane of the bony Eustachian tube was very much thickened and infiltrated with small round cells in the superficial parts and in the deeper parts in the neighborhood of the tympanum.

SCHUMACHER, H., Wratsch Gaseta, No. 19, 1902, in a paper, Ear Disease in Abdominal Typhoid, states that ear complications from typhoid are more common in children; that infection reaches T. by the way of the blood and Eustachian tube, and that syringing of the nasopharynx is to be avoided because of the liability of forcing the passage of secretions through Eustachian tube to T.

SCHWARTZE, Gehör-organ, pp. 103-104. A luxuriant tubercular growth surrounding the pharyngeal recess (fossa of Rosenmüller) on one side was observed. The recess itself was converted into a crater-like excavation twice the depth of its fellow.

SIEBENMANN, F., On the First Appearance of the Auditory Ossicles and the Tubotympanic Space in Man. Report Proc. 3rd meeting German Otolg. Soc., 1894. Arch. of Otolology, XXIV, 1895, p. 56. "Examination of human embryos of the 3rd to 6th, 8th week showed that the blastem of the cartilaginous capsule appears in the 4th week, that of the annulus stapedialis in the 5th and that of the malleus and incus in the 6th week. Even at the earliest stage the blastem of the annulus stapedialis lies near the labyrinth capsule as well as the dorsal end of the forecartilage of the second pharyngeal arch. The stapes is not of double origin. The space corresponding to the medial wall of the tympanic cavity exists at the first month as an undifferentiated portion of the pharyngeal cleft, a separation of the tubotympanic space taking place in the first half of the second month by the nearer approach to each other of the dorsal and ventral wall of the pharyngeal cleft and by the advancement of a solid mesodermic layer, closing the tympanic cavity below."

SIEBENMANN, F., Results of the Functional Examination in Cases of Pure Catarrh of the Eustachian Tubes. Trans. by E. B. Dench. Arch. of Otolology, XXII, 1893, pp. 12-16. Bezold found 9 per cent. of pure tubal catarrh among his entire series of cases. Two isolated reports of Bezold treat of the symptoms of tubal catarrh. In a large number of cases catheterization showed no secretion in the middle ear. Mt. was usually depressed, but no signs of inflammation. On inflation the Mt. resumed its normal appearance and hearing was improved to a marked degree. Before inflation hearing distance for whisper was greatly diminished, 10 to 500 cm. (normal distance, 15 metres). In Weber's test the sound was referred to the affected ear. Weber-Schwabach test marked increase in bone conduction in affected ear. Rinne's test was positive in only two cases; in all others, negative. Upper tone limit was below normal. Lower tone limit was usually curtailed. Inflation produced an increased hearing distance. In fact, only cases showing marked improvement by the procedure were considered in this class of cases. Schwabach's test was only slightly altered. The results obtained by Rinne's test were shortened or reversed, be-

coming positive in all but two cases. The upper tone limit remained unchanged in half the cases. The lower tone limit was increased. Bone conduction remains stronger after inflation. This latter phenomenon is regarded as due to the hyperemia ex vacuo always present in tubal catarrh. In consequence of this hyperemia there is likewise a rigidity of the annular ligament of the stapes, even after the aspiration position is corrected. This rigidity does not disappear for some time. It is possible to assume that the portion of the scala vestibuli lying near the oval window serves to affect the perception of the highest notes; that this part suffers from passive hyperemia and that this cannot be removed immediately but only gradually.

STENGER, P., On the Etiology and Treatment of Sclerosis of the Middle Ear. *Deutsche med. Wochenschr.*, XXIX, 1903, pp. 513-514. The process is regarded as an inflammation originating in the nose and pharynx, thence extending through the Eustachian tube to the ear.

STILLSON, HAMILTON, Experiments on the Eustachian Tube by means of the Tongue Thrust Into the Nasopharynx. *Laryngoscope*, Vol. III, 1897, pp. 38-47. The experiments of Hammerschlag (1st Aust. Otol. Cong.) are criticised. Stillson by means of the manometer shows that contrary to Hammerschlag's belief, during the time the Eustachian tube is actually open throughout its length the Mt. moves extensively outward during expiration and inward during inspiration. Stillson is able to introduce his own tongue behind his palate and so, at will, to close the tubes completely with his tongue. On thus closing the tubes all motion of the Mt. ceases in both inspiration and expiration. (2) With the mouth closed, i. e., with the Eustachian tubes as normal, the manometer shows the phenomenon mentioned by Hammerschlag. Now the index in inspiration moves outward; in expiration, inward. In breathing through the nose the excursions of the Mt. are more extensive than with mouth respiration. This same excursion of the membrana tympani takes place in the same way when the tongue pushes forcibly into the nasopharynx and completely closes the Eustachian tubes. Likewise the motions synchronous with the heart beats



occur whether the tongue closes the Eustachian tube or not. Stillson says it is therefore evident that the "respiratory" movements and pulsatory excursions have nothing to do with the rarefaction or compression of air in the tympanic cavity through air passing directly through the tube in normal respiration. Stillson thus concludes that the Eustachian tube is normally closed during deglutition. Stillson does not know what causes this reverse movement of the drum in normal respiration, but suggests that the cause is due to the increase of blood pressure in the head on inspiration and to lowered pressure on expiration. By noting the behavior of the pharyngeal mouths of the tubes with the aid of the tongue Stillson finds that in swallowing, the pharyngeal portion of the tube is drawn up and pushed up so as to be tightly coapted to the end of the introduced catheter. This is chiefly accomplished by the constrictor muscle. Politzer's conclusion from experiments with the manometer are also regarded by Stillson as in error, Stillson believing that the increased sound of a vibrating tuning fork held in front of the nose during the act of swallowing is due to condensation of the air in the tube and ear, and claiming that pressure of the tongue into the mouths of the tubes completely closing them, produces a similar effect.

STIRLING, ALEX. W., Itching of the Auditory Meatus. *Laryngoscope*, VIII, 1900, p. 146. Stirling thinks itching of the meatus of the ear is sometimes caused by irritation from inflammation or irritating applications at the pharyngeal end of the Eustachian tubes.

TANSLEY, J. OSCROFT, A Piece of Bougie in the Eustachian Tube. *Laryngoscope*, XIII, 1903, pp. 36-40. A bulbous point of a bougie was found in the mouth of the tube where it had broken off. The method of treatment is also disapproved of by the author.

THOMSON, ST. CLAIR, Approximation of the Remains of Luschka's Tonsil and the Eustachian Cushions. *Laryngoscope*, IX, 1900, p. 58. Thomson believes "Sinuses in the vault of the nasopharynx" were nothing but depressions produced, as the title of his communication describes, by the approximation of the remains of Luschka's tonsil and the Eustachian cushions.



TRUCKINBROD, C., A Malformation of the Ear. *Archiv. of Otology*, XIV, 1885, pp. 128-132, pl. II. In this case of marked deformity, there existed complete closure of auditory canal, middle ear very small, rudimentary ossicles. No trace of a drum membrane was found, solid bone being found in its situation. Eustachian tube was present. The tube had a large, quite uniform diameter throughout its length. Its vertical diameter at its opening into the tympanic cavity was 4 mm. Its length 2.4 cm., 1.4 cm. of which belongs to the bony tube. No isthmus tubae proper was found; its diameter at this situation was 2 mm. The tympanic cavity appeared as a considerable expansion of the extremity of the tube.

UFFENORDE, W., The Auscultation of the Middle Ear. *Arch. für Ohrenh.*, LXVI, 1902, p. 1. No diagnosis can be made by means of the distinctions of the sound, as to whether it is due to tubal or middle ear condition, as it may meet an obstruction which may absorb or reflect sound waves. (2) The blowing noise comes from the end of the catheter and the tube, the middle ear acting as a resonator. (3) No conclusion as to the consistency of the secretion can be drawn from the musical character of the sound. (4) Rales from the middle ear have a deeper note and a secondary sound due to the secretion falling backward. The tubal rales are higher and fewer. (5) If no auscultation sound is heard in a moist catarrh, the obstruction is usually in the tube. (6) Under ordinary conditions most of the secretion leaves the middle ear via the Eustachian tube. (7) A whistling noise indicates secretion, but gives no clue as to the size of perforation. In two cases the presence of crepitant rales during catheterization suggested the presence of an exudate in the middle ear. On incising the membrane, no fluid was found. Uffenorde then investigated the subject of the generally accepted opinion regarding exudates of the tympanum. He used a fresh cadaver and disarticulated temporal bones. He finds it impossible to determine with the otoscope whether the sounds heard are near to, or far from, the ear of the observer. A vesicular murmur is produced principally at the end of the catheter and at the walls of the tube. The tympanum serves as a resonator. The musical char-

acter of the crepitant rale does not inform us as to the character of the secretion. Crepitant rales produced in the tympanum is regarded as due simply to changes in position of the secretion. This accounts for an unusual intensity of sound and by a musically lower note. The lower after-murmur is due to the secretion falling back into its former position. Tubal noises are higher and less intense, corresponding to the smaller amount. The bursting of air bubbles can only explain a part of the secondary noises. If there is moist catarrh present and an auscultation murmur is perceived the obstruction is probably tubal [!]. Conditions being favorable, removal of the discharge from the tympanum is probable of accomplishment through the tube into the epipharynx. If the amount is small its evacuation is of importance. In the presence of a perforation, whistling murmur denotes secretion, but it is not necessarily related to the size of the perforation. A perforation murmur may occur with an entire absence of the drum.

URBANTSCHITSCH, V., Bougieing the Eustachian Tubes in Chronic Disease of the Middle Ear, Especially in Chronic Middle Ear Catarrh. Wiener med. Presse, Vol. 24, 1883, pp. 48-73. After chronic middle ear catarrh there often remains a narrowing of the tube, especially at the isthmus, though the entrance of air is not much interfered with. He regularly uses bougies, on examination, in diagnosing O. M. C. C., employing the French bulbous bougies. He advocates the dilatation of all tubes in cases of impaired hearing and subjective noises in which a bougie 1 1-3 mm. diameter cannot enter the bony portion or where it enters with great difficulty. Improvement takes place, he believes, by a reflex influence generated by the irritation of the sensitive twigs of the trigeminus, especially the tubal branches. This influence, he thinks, extends to all the senses, and, of course, to the ear. He employs the bougies in chronic suppuration when associated with narrowing of the isthmus tubæ.

URBANTSCHITSCH, ERNST., Vibratory Massage of the Eustachian Tube in Chronic Middle Ear Catarrh. Monatsch. für Ohren., XXXVII, 1903, pp. 89-96. The thin celluloid bougie is introduced to the isthmus of the tube; then ex-

ternal massage is employed by means of a pad set in motion by a motor, and continued four minutes. Urbantschitsch thinks circulation is improved in tensor tympani and tubal muscles and in middle ear. He reports improvement of subjective noises.

URBANTSCHITSCH, V., An Apparatus for Friction Massage of the Ear or Eustachian Tube. *Monatsch. f. Ohren.*, XXXVI, 1902, pp. 455-467. An apparatus is constructed which has two electric magnets on a rod, arranged to convey various movements to the mucous membrane of the mouth of the tube and the nasopharynx.

VAJDA, V., Syphilitische Infection der Tuba Eustachii. *Bericht der Klinik für Syphilis des K. K. Allgemeinen Krankenhauses, Wien*, 1875. A case of syphilitic infection at the mouth of the tube from an infected Eustachian catheter.

VALENTIN, AD., The Cystoscopic Examination of the Nasopharynx or Salpingoscopy. *Frankel's Arch. für Laryngol.*, XIII, 1903, pp. 410-420, Taf. XXII. The condition of the tubal ostium, upper wall of the nasopharynx and the posterior surfaces of the velum are rendered visible by a cystoscope-like apparatus introduced through the nose.

VALI, On Objective Noises of the Ear. *Arch. für Ohrenheilk.*, LXVI, 1906, p. 104. Objective noises usually develop from an abnormal circulation or tonic and clonic contractions of the muscles of the tympanum and in the pharynx. A case synchronous with pulse was not arrested by pressure on the carotid, but was stopped by depression of the tongue, by elevation of the soft palate and by catheterizing the tube. Regarded as due to clonic contractions of tensors and palate muscles.

VOLTOLINI, R., Two Peculiar Ear Diseases. *Monatschr. für Ohrenheilk.*, XVII, 1883, pp. 1-6. A twenty-year-old patient had for five years sensations of sudden valve-like closures of the ears lasting for some time. At these times examination revealed a thin atrophic Mt., bulging outward and containing frothy mucus. By negative Valsalva the Mt. was made to withdraw against the inner T. wall. By slightly swallowing, the first condition reappeared. Diagnosis: Dilatation of the Eustachian tube with exudation, confirmed by insertion of catgut bougies. Respiratory vibration of the Mt. was noted. On pronunciation of the letter R, a fluttering vibration was developed.



- VOLTOLINI, R., On the Catheterization of the Eustachian Tube in Cases of Palatal Fissure, and the Inspection of the Nasal Cavity from in front while it is being illuminated from behind. *Monats. für Ohrenheilk.*, XVIII, 1884, pp. 7-8. In a patient with a cleft of both soft and hard palate, the posterior lip of the tube, but not its mouth, was visible through the oral cavity.
- WARNECKE, G., Simple and Vibratory Catheterization with a Current of Carbonic Acid Gas. *Archiv. für Ohrenheilk.*, LXVIII, 1904, pp. 227-232. The gas is led by a tube to the catheter. The intermittent current is thought more active than the continuous.
- WHITE, F., Complete Deafness for Twenty-four Years from Eustachian Closure. Perfect recovery after a course of Politzerization. *Brit. Med. Journal*, March 2, 1895.
- WOLF, OSCAR, Review of Hartmann's "Experimentelle Studien ueber die Function der eustachischen Röhre." *Archives of Otology*, VIII, 1878, pp. 209-211. He cites Hartmann's experiment showing that a slight pressure from within the middle ear only is necessary to overcome the closure of the tube, as a support to his theory that the Eustachian tube is protective by furnishing an outlet for sound waves. Loud sounds would, he thinks, produce grave changes in the ear without it.
- WOLF, OSCAR, *Sprache und Ohr.*, p. 240. Wolf states his experimental proof that the tube is for the outlet of sound—a protective mechanism. It permits the sound waves to escape from the rigid walls of the osseous tympanum into the external air.
- YANKAUER, SIDNEY, Eustachian Sounds. *Archives of Otology*, XXXV, 1906, p. 247. The sounds described and here recommended by Yankauer are made of catgut surrounded by a resin. They bear sterilizing. They are not bulb-pointed. They are ringed near the proximal end for convenience in determining the distance introduced.
- ZAUFAL, E., *Die Plica Salpingopharyngea*. *Prague med. Wochenschrift*, Vol. IV, 1879, pp. 217-227. Calls this fold the ridge-fold. He observes that it projects forward in (swallowing) movements as a sharply defined medial fold of variable thickness. It extends 3—5 centimeters downward and backward as a direct continuation of the



tubal convolution. When the head is bent backward it can be directly observed with the aid of an uvula retractor.

ZAUFAL, E., *Die Plica Salpingopharyngea*. Arch. für Ohrenheilk., Vol. XV, 1879-80, pp. 96-144. The various diseases affecting the fold are described. It is the seat of pronounced swelling and tumefaction. Cystoid follicles may develop in it, which tend to obstruct the mouth of the tube,

ZUCKERKANDL, E., *Zur Anatomie und Physiologie der Tuba Eustachiana*. Monatsch. für Ohrenheilk., VII, 1873, pp. 125-145. Bundles of fibers, tendinous and elastic, pass from the pharyngeal end of the tube to connective tissue of the levator palati, the muscles of the pharynx and soft palate. These aid in drawing open and closing the orifice as different muscles are contracted.

ZUCKERKANDL, E., *Anatomische Notiz über die Tuba Eustachiana eines Elephas Indicus*. Monatschr. für Ohrenheilk., IX, 1875. There is no projection on the pharyngeal wall to mark the opening of the Eustachian tube in this animal, and it is discoverable only with some difficulty. It is almost exactly vertical. The ostium pharyngæum possesses no distinct cartilaginous boundary and appears as a small, irregular slit, the thick lateral wall longer than the membranous, median wall. The tubal cartilage is thicker above, assumes the form of an almost complete cylinder nearly surrounding the tube at its median portion. The tube is fixed to the skull by a comparatively slender fibro-cartilage.

ZUCKERKANDL, E., *Contributions to the Anatomy of the Organ of Hearing*. Reviewed in Arch. of Otology, XIV, 1885, p. 211. On dissection, a small piece of bone, the size of a hemp seed, was found in the anterior wall of the Eustachian tube, the pharyngeal orifice being otherwise normal. The spicule was firmly adherent to the mucous membrane, and Zuckerkandl regards it as a circumscribed ossification of the cartilage. (Moos has published similar findings.) Accessory cartilaginous plates in the floor of the Eustachian tube, in the pharyngeal prominences, the lateral walls, in the ligaments connecting the cartilaginous portion of the tube with the vault of the pharynx are so commonly found as to be considered normal.

ZUCKERKANDL, E., *On the Eustachian Tube of the Ant-Eater*.

Monatsch. für Ohrenheilk., XXXVIII, 1904, pp. 1-7. Zuckerkandl differs from the view of Hyrtl (1845) that the bony tube is absent in *Myrmoscophaga jubata*. Zuckerkandl finds a bony tube 15 cm. long without any cartilaginous filament attached to the margin of an opening in the temporal bone by which it communicates with the tympanum. Zuckerkandl thinks Hyrtl mistook this opening for the carotid foramen.

ZUCKERKANDL, E., On the Anatomy of the Eustachian Tube. *Monat. f. Ohrenheilk.*, XL, 1906, pp. 1-11, etc. In these papers Zuckerkandl gives results of his studies of the comparative anatomical characteristics of this region. The greatest differences are in the structures of the tubal walls, especially of the median walls. The lateral walls are approximately uniform, and usually fibrous. The median walls show varieties from fibrous to cartilaginous. In the lower forms of vertebrates the median walls are usually fibrous, showing that the primitive tube was represented by a fibrous tube.

ZUCKERKANDL, E., A Contribution to the Comparative Anatomy of the Eustachian Tube. *Arch. f. Ohrenh.*, XXXIII, 1886, pp. 201-213. The Eustachian tube of the *Ornithorhynchus paradoxus* or Duck-billed Platypus, is not tube-shaped, but is represented by a simple fissure, which connects the tympanic cavity with the slightly pouched pharynx. All other mammals examined have a tube-shaped structure. This animal thus resembles in this structure the amphibia, the batrachia in general exhibiting a similar connection between the ear and the pharynx.

ZUCKERKANDL, E., The Eustachian Tube of the Tapir and Rhinoceros. *Arch. f. Ohrenheilk.*, XXI, 1884, pp. 222-232. The Eustachian tubes of the tapir are remarkable by reason of a smooth, narrow-edged air-sac, the size of a hen's egg, situated about 8 mm. behind the pharyngeal opening of the tube, extending upwards 45 mm., connecting with the cartilaginous portion of the tube and reaching posteriorly 22 mm. beyond the auditory organ. The comparatively small amount of hyaline cartilage in the tube is placed at the superior wall, and projecting downward medially and laterally form here a sort of groove. The medial wall contains fibrous cartilage as support. The

levator palati is pushed outward by the air-sac. The membranous lining of the tube presents numerous ridges, especially on its floor. It contained no acinous glands, but adenoid tissue in the shape of follicles were found. The air-sacs resemble those found in the horse. The Eustachian tubes of the rhinoceros were found in the adult to be 89 mm. long. In the neighborhood of the junction with the bony tube a vascular network exists formed by arterial twigs from the internal carotid and distributed into the cavernous sinus. The hyaline cartilage has the typical shepherd's crook shape. The narrowest portion of the tube is near the middle of its length. Bundles of fibrous tissue containing some hyaline cartilage cells strengthened the cartilaginous tube. The mucous lining of the tube was paved with ciliated epithelium; contained acinous glands in its deep layers and adenoid tissue superficially.

## X.

### WHY THE FAILURES AFTER RADICAL MASTOID?

By JOHN F. BARNHILL, M. D.,

INDIANAPOLIS.

I cannot proceed with this paper without first expressing to the officers and members of the section a feeling on my part both of gratification and regret—gratification from the honor of the invitation to appear before so distinguished a body of specialists, and regret because at this time, when your city is celebrating in a most magnificent and befitting way the accomplishment of some of the greatest feats in the world's history, I am unable to bring to you any new message or highly useful application of an old or well-established principle. I consented to come before you because a rather intimate knowledge of the work that has been done and is daily being accomplished by the individual members of the society was to me a guarantee that I should receive from my brief association with you here a renewal of the intense and earnest inspiration to accomplish greater things, which is an asset so necessary in the practice of an art so difficult as that of ours.

At a session of a noted association of gynecologists, at which I happened to be present, a heated discussion arose concerning the results of a certain operative procedure, and the statement was made by an overzealous member that he had operated an almost incredible number of times without having witnessed a single failure from his method. A colleague, in answer to this statement, said that whereas his apparently faultless brother had never witnessed a failure following his favorite procedure, other operators, including the speaker, had several times had such opportunity, probably for the reason that when failure resulted, the patient often chose to go to another physician for further treatment, rather than return to him whose pet operation had been performed and whose failure it was. Judged by the private statements of several otologists, that failure to cure, following the radical mastoid operation, in their hands seldom



or never occurs, it must be true, to some extent at least, that the mastoid surgeon, like those practicing gynecology, is often deceived as to the actual number of his uncured cases, but has opportunity to observe more failures among the cases of his fellow operators than his own. However this may be, it is probably true that should we honestly analyze the ultimate result of our entire work, few among us could say in truth that they had never witnessed failure in our own practice following the tympano-mastoid operation. My own experience in this respect probably differs little from others, in that I have seen failure to cure following operations that had been performed by those eminent in the specialty, as well as by those but slightly known or not at all known. It must be, therefore, that some rather constant cause or group of causes is responsible for disappointing results, and that definite and possibly avoidable reasons for failure may be present in all cases. Granting this to be true, a brief statement and discussion of these causes may be helpful to those of us who are anxious to do more perfect work, but who have not, as yet, mastered a perfect plan.

Failure of the radical mastoid operation to cure chronic supuration in the temporal bone, or its environs, may be due to an anatomic anomaly of the osseous structure in the particular case. It may be the result of indifferent asepsis at the time of the operation, but chiefly during the period of after-care. It is almost inevitable following a faulty technic or an incomplete operation; it is not unknown following the work of skilled operators who neglect the proper and personal after-care of the wound.

Failure due solely to an anomalous structure of the temporal bone occurs rarely, no doubt, and in instances where the mastoid cellular labyrinth is of great extent and leads into depths at which operative procedures cannot be carried out with safety. There are well-described specimens in which normally the pneumatic spaces reach not only a large portion of the temporal bone, but extend, also, into the substance of adjacent bones, in one notable example of which, the specimen of Dr. Wales, direct communication seems to exist between the cells of the temporal bone and those of the sphenoid and occipital. When suppuration occurs in any patient whose mastoid cells are of this character it is obvious that operative procedures directed toward a cure cannot always be extensive enough to include

all the diseased structures. The beginner and timid operator are almost certain to meet failure in such case, and even the expert surgeon may suffer a like result, for the reason that structures may be involved in the disease around which or through which the boldest and most skillful operator dares not go.

*Incomplete Operation and Faulty Technic.*—I am aware that what may seem faulty technic in the work of one surgeon may, to that surgeon, prove a satisfactory means of securing the most desired end, namely, the cure of the patient. This is true, for the reason that it is undoubtedly possible to do inferior surgery and yet ultimately succeed because of the untiring and intelligent after-care that is given the patient. I shall not at this time, therefore, discuss the merits of any given procedure, merely stating that it is entirely essential to success, whatever plan is followed, to adhere to a technic most nearly ideal in general surgical principle, which, in case of the mastoid operation, insures the removal of the diseased structures, provides the greatest possible are of integumentary covering for the denuded bone, and finally, which guarantees the greatest ease of subsequent inspection and after-treatment of the wound.

An analysis of the cases of failure I have seen has shown that more than one-third were due to incomplete operation; that all the diseased structures had not been removed. This was especially true of the external attic and antral walls and of the deeper osseous areas in proximity to the facial ridge and horizontal semicircular canal. In a few instances it was noted that the chief cause of the continued suppuration was due to the fact that the osseous postmeatal wall had not been removed to sufficient depth, that it had not been smoothed and rounded, and that it projected into the antroaural cavity as a ridge, too sharp and too high to admit the growth of a perfect and permanent epithelial covering. Normal granulation and epithelial structures seem entirely incapable of climbing and covering sharp ridges of bone, or of satisfactorily spreading into pockets having acute, angular or overhanging walls. Failure is constantly invited, therefore, in any case in which the operator allows such ridges, angles or pockets to remain in the operated wound.

Every surgeon who operates frequently on the accessory suppurative sinus affections is aware of the fact that failure to

cure as a result of any operative procedure is almost inevitable in any case in which even a small portion of the old pyogenic membrane is left behind. This is true, whether the failure to rid the suppurating cavity entirely of its diseased membrane be in the frontal or maxillary sinus; and the same rule of failure holds equally good in case any of the diseased membranes of the middle ear or antrum is left behind.

Many operators have, no doubt, witnessed failure in their own as well as in the cases of others, due to continued patency of the eustachian tube, and to the consequent outpouring into the tympanic cavity, especially during nasopharyngeal colds, of thick, string, mucous or muco-pus. The fault is due to lack of thoroughness or skill in dealing with the tympanic end of the tube at the time of operation. And yet in some cases in which it was believed at the time of operation that every necessary care had been bestowed toward that end, closure had not followed, and the aural discharge continued. In some cases this is undoubtedly due to a state of obstruction and infection of the tube at its pharyngeal end. In this respect the situation may be aptly compared to that of radical operation on the suppurating frontal sinus, in which operation, we are all now agreed, I think, that cure cannot be expected from the most radical operation on the sinus alone unless the anterior ethmoidal cells, when diseased, are at the same time thoroughly eradicated. Likewise, therefore, the presence of adenoids, other obstructions, or nasopharyngeal inflammation may be responsible for the continued discharge from the patent tube, and it has demonstrated that the middle ear will often speedily dry up without further treatment, provided the environment of the nasopharyngeal end of the tube is put right. It has certainly not been satisfactorily proven that a patent tube is of itself especially harmful, whereas its continued patency adds something to the comfort of the patient and to an increased ability to hear.

Postoperative suppuration occasionally sets up many months after the operation, and after the ear had for a long time been dry, as the result of an accumulation in the cavity of a semi-cholesteatomatous mass due to rapid cell proliferation and ex-foliation. The irritation and pressure of such a foreign body, if allowed to remain indefinitely, may cause ulceration and permanent discharge, but usually a flow due to this cause should not be reckoned among the causes of permanent failure.



Failure to cure because of failure to remove every diseased structure is by some operators justified on the ground that it is far better for the patient to suffer the continued annoyance of a moderate, though perhaps innocent discharge, rather than run the risk of facial palsy, distressing vertigo, sinus infection or death, any of which may result from a reckless and determined effort on the part of the surgeon to eradicate every vestige of the disease. Such caution is on doubt at times wise for the master operator, and is undoubtedly proper in case the surgeon is a novice, or is not thoroughly grounded in the anatomy of this region.

Failure to cure in several observed cases seemed clearly due to the fact that the operator in fashioning the skin flaps had not provided a sufficiently spacious opening into the operated cavity through which subsequent inspection and treatment might at any time be made. My observation on this point leads to the rather positive conclusion that it is highly essential in a majority of all mastoid operations to provide ample means for observing daily, if necessary, the behavior of every part of the wound until epidermization is complete, for should there be neglect in this respect, carious areas may form, riotous granulation tissue spring up, pockets capable of retaining septic material may form, and, before the surgeon is aware, the new structures may break down completely with resulting failure. It seems evident, therefore, that the relationship between the size of the meatal opening provided by the mastoid operation and the successful postoperative treatment and final cure is very intimate, and that no amount of zeal on the part of the operator in the after-care of the patient can compensate for failure to leave a proper window for inspection, because if the meatus be not enlarged, all posttreatment must be given blindly and therefore inefficiently.

Excessive or long-continued packing of the osseous cavity, though perhaps not a frequent cause of ultimate failure, is, however, no doubt responsible for prolonged healing in many cases and for failure in some. Prolonged packing is fortunately not now employed so frequently as formerly and should, no doubt, be abandoned altogether, except at the first dressing, when support is necessary to insure adhesion of the skin flaps.

Neglect or indifference on the part of the operator to the progress of the granulation and epidermization is responsible



for many of the failures after tympanomastoid exenteration. The healing of an open osseous wound, unless the same has been successfully skin-grafted, can seldom be left entirely to nature's plan of repair. Indeed, the satisfactory management of the epidermization process often requires the exercise of as much care and judgment on the part of the surgeon as does the operation itself. This part of the after-treatment can, therefore, rarely be left to untrained physicians, whether the same be the family doctor or hospital interne, without running a serious risk of failure to cure. My own observation on this point is that on one, unless he has served a studious and adequate apprenticeship in the care of osseous wounds, is at all capable of having full charge of the postoperative care of the radical mastoid, and this, on doubt, accounts for the failure sometimes observed in the patient who goes from the rural district to the metropolis for the operation by the most skillful surgeon, but who is suffered to return home to the family physician or perhaps to mere household after-management before healing is complete.

All who have studiously watched the progress of repair in a large number of cases following the tympanomastoid operation, are aware that the behavior is often most surprising in that the granulations will sometimes bridge across some portion of the cavity, especially at the aditus ad antrum, in an incredibly short time, and occupy such position as to hinder drainage, favor infection and speedily end in disintegration of the new structures, with possible death of the underlying bone. Should granulation behave thus to the detriment of proper healing, prompt recognition of the fact by the experienced surgeon, and the immediate institution of suitable measures to correct the error usually ends in no permanent harm. On the other hand, if the fault is not promptly recognized and efficiently corrected, it matters little that a most thorough and painstaking operation had been previously performed, for all will now result disastrously unless a secondary operation is undertaken, and then more watchful after-care is given.

I have not mentioned failure due to lues, tuberculosis and certain diathetic diseases, for the reason that failure here in a considerable percentage of all operations on patients so affected must be looked upon as inevitable. In addition to causes here noted contributing to failure, it has been my observation that

cases sometimes occur which do not get entirely well, even though every recognized principle in modern surgery has been followed and the most careful and competent after-care is given; and this, too, in individuals who are apparently free from constitutional disorder of any kind. It is not easy in such case as this to assign a definite cause of failure.

## XI.

### INTRANASAL MEASUREMENTS WHICH INDICATE THAT PALATAL EXPANSION INCREASES THE WIDTH OF THE NASAL FOSSAE.\*

BY E. E. FOSTER, M. D.,

NEW BEDFORD.

The exact factors in the causation of deformities of the superior maxilla and the relationship between these deformities and imperfect nasal breathing have given rise to a large amount of discussion and varied opinions.

Certain writers believe that these deformities are dependent upon the type of the skull, while others believe that they are due to influences during development.

The former opinion is championed particularly by Siebenmann<sup>1</sup> and his scholars, Fraenkel<sup>2</sup>, Grosheintz<sup>3</sup> and Haag<sup>4</sup>. They devised an instrument (palatometer) with which they measured the width of the alveolar arch and height of the palatal arch of different individuals with and without "adenoid vegetations," this being the principal cause of nasal obstruction which they considered. From these measurements they calculated an index, and by comparing these indices they arrived at the conclusion that individuals with "adenoid vegetations" had relatively the same height of palatal arch as normal, and are of the opinion that the high palatal and V-shaped alveolar arches depend upon the type of the skull. The normal type (chamoprosope) is the broad face with the wide nasal cavities and dome-shaped palate. The abnormal type (leptoprosope) is the one with a high, narrow face, narrow nasal cavities (leptorhine), high palatal arch and V-shaped alveolar arch. They believe these types depend upon the congenital racial characteristics of the skull, and not upon the extrauterine influence of nasal occlusion.

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\*Read at a meeting of the New England Otological and Laryngological Society, November 29, 1909.

Siebenmann says, in explanation of the common association of palatal deformity with mouth-breathing: "That the individual with a high palate, without exception, has narrow nasal cavities, and the swelling of the nasal mucous membrane which is rarely absent with "adenoid vegetations" becomes more obstructive when the palate is high and narrow than when low and broad; consequently oral respiration is seen more often in individuals with a narrow face."

This view has been confirmed in part or in whole by Brackett<sup>5</sup>, Bentzen<sup>6</sup>, Arnold<sup>7</sup>, Swain<sup>8</sup>, Hurst<sup>9</sup> and Buser<sup>10</sup> by measurements upon the faces and skulls of European, Malay, Hawaiian and Flathead Indian races, before and after death.

In support of the opposing theory: that the deformities of the superior maxilla are due to influences during development, we have a long list of writers<sup>11 22</sup>, a large number of whom consider imperfect nasal respiration as the most important factor, and explain its influences in the following manner:

During normal nasal respiration the lips are closed, the teeth of the opposing jaw are in contact, and the tongue completely fills the oral cavity with the exception of a small space between the dorsum of the tongue and hard and soft palate. This space, according to Metzger<sup>23</sup> and Donders<sup>24</sup> has a negative manometric pressure of from 2 to 4 mm.

In this position the muscles are in a state of balance or tonicity which, in accordance with the generally accepted opinion, maintains the relative position of the jaws to each other. The muscles of the lips and cheeks on the one side and the tongue on the other exert equal pressure upon the alveolar arch.

If the nasal respiration be obstructed by any cause interfering with the free passage of air, the nasal respiration is partly or completely abandoned; and, as a result, air must pass through the mouth, a cavity not intended for such use, and certainly unfit to properly prepare the air for the lungs.

When nasal respiration is impossible, the mouth must perform two functions during the ingestion of food: that of preparing the food for the stomach, and supplying air to the lungs.

The baby at the breast requires about fifteen or twenty minutes for the ingestion of a single meal. Under normal conditions it does not remove its mouth from the breast during



that time, but, if nasal breathing be impossible, oral respiration must be resorted to, and as a result the baby can suck the nipple only a short time before partial asphyxia forces it to stop nursing. This procedure is repeated until hunger is satisfied, or, more often, the baby is exhausted by its efforts to supply the stomach and lungs at the same time. Either a moderate amount of milk mixed with air is swallowed, or an insufficient amount of nourishment is taken. Both tend to produce indigestion and malnutrition.

It is an established fact that oral respiration is not so deep and long as nasal, and as a consequence the interchange of gases within the lungs is not so complete. This allows an excess of carbon dioxid to remain in the blood, and a deficiency of oxygen to be absorbed. Kyle<sup>19</sup>, confirms this latter statement by his findings in a series of examinations of the blood of persons with nasal obstructions. He found in every case, before removal of the obstruction, a reduction in the number of red corpuscles, the hemoglobin was found to be only 50 to 60 per cent of the normal, and in many cases there was a slight increase of the white corpuscles.

After nasal respiration had been established the cells and hemoglobin gradually returned to their proper number and percentage.

Oral respiration also interferes with sleep. Instead of a quiet, restful sleep, it is often interrupted with sudden awakenings and exhausting dreams.

Thus we frequently find as a result of oral respiration, indigestion, due to improperly prepared and digested food; impoverished blood, resulting from an incomplete exchange of gases within the lungs; and insufficient sleep which so weakens a growing child that not only is dentition delayed and decay of the teeth started, but the bony framework of the head and body is retarded in growth, and the resistance of the whole body is lowered to the invasion of pathogenic bacteria.

There are also the following local factors resulting from imperfect nasal breathing which are supposed to influence the shape of the developing superior maxilla:

1. Absence of the mechanical force of the air upon the walls and sinuses of the nose, and the abeyance of the natural functions with the want of proper blood supply.

2. Lack of constant apposition of the upper and lower teeth;

which destroys an important factor in forcing outward the teeth of the superior maxilla.

3. Continual downward and inward pressure against the lateral teeth by the muscles of the cheek, which support the hanging mandible, and the absence of the backward pressure of the orbicularis oris muscle upon the anterior teeth.

4. Loss of the vacuum between the upper surface of the tongue and hard palate, which in accordance with the findings of Metzger<sup>23</sup> and Donders<sup>24</sup> must tend to pull the palate downward.

5. Absence of the constant lateral pressure of the tongue against the alveolar arch, which has a regulating and widening influence.

As a proof of the theory that the interference of nasal breathing does have an influence in the abnormal development of the superior maxilla, the experiments of Ziem<sup>25</sup> and Collier<sup>26</sup> may be cited. Ziem found that by artificially occluding one-half of the nose in young animals there occurred an asymmetrical development of the two sides of the nose and adjacent bone tissues, the obstructed half being undeveloped. This arrest of development extended to all adjacent tissues on that side. Collier produced deformities of the upper jaw in young animals, chosen indiscriminately, by blocking their noses for a long time with cotton wool.

As additional evidence of the influence of oral respiration upon the upper jaw, I will briefly report the condition of two of my patients. One was a girl seven years of age, whose brother and sister had normal arches and occlusion. The mother was a strong, broad-faced Swede. Father dead. This child fell from a chair when a baby, striking on its face. When I examined the child, December, 1905, I found the cartilaginous part of the septum bent in such a way as to obstruct both nasal passages. The child had breathed through its mouth since the accident.

The other patient was a boy seven years old. His parents were both large, with normal heads. His brother and sister both had normal arches and perfect occlusion. The mother knows of no accident to account for an irregularity of the external shape of the nose, but says the child has breathed through its mouth for a long time. On examination, January, 1907, I found an angular deviation of the cartilaginous sep-

tum, obstructing both nasal cavities. This irregularity is certainly the result of trauma, and of long standing.

Both patients had a high palatal arch, V-shaped alveolar arch, a moderate degree of malocclusion and decay of nearly all the upper teeth.

Faught<sup>27</sup> cites the case of a football player who developed a markedly contracted upper arch after a traumatic deviation of the septum which interfered with nasal breathing. Models of the upper jaw had been made a few years prior to the accident. These showed practically a normal arch and occlusion.

Lack<sup>28</sup> reports a case which seems to prove the influence of muscle pressure. A boy, twelve years of age, who was a mouth breather. He had had facial paralysis on the left side for ten years; the soft parts were consequently flaccid. The teeth on this side were normal in their position while those on the other side were irregularly placed and crowded.

The only apparent factor in this case which could cause a difference between the two sides was the facial paralysis which removed the tension of the cheek on the paralyzed side.

Of the other causes of palatal deformity during development, rickets has a prominent place. Löwy<sup>29</sup> believes the changes of rickets are the cause of all irregularities of the superior maxilla and nasal septum, while Marfan<sup>30</sup> and Stone<sup>31</sup> are of the opinion that these irregularities are more dependent upon rickets than any other single factor. Talbot<sup>32</sup> states that the causes of the arrest of development of the maxillary bones and irregularities of the teeth are the influence of eruptive diseases and constitutional disorders, and those of local origin. He does not believe mouth breathing has any influence on the shape of the upper jaw, and states that every case of adenoid growth and irregularity of the teeth will be found to be a case of degeneracy, shown by want of development in the bones of the face and jaw.

It has been rather generally accepted that idiocy and degeneracy are characterized by irregularities of the palate and teeth. This, however, has been partly, if not completely, disproved by the work of Channing and Wissler<sup>33</sup>. They conclude from measurements made of a large number of cases of the mouth of both normal and abnormal individuals, that deformities of the palate occur in the normal as well as the



feeble-minded, and show only a slight difference in degree, but not in the type.

Premature loss or prolonged retention of the deciduous teeth, tardy eruption or loss of the permanent teeth and supernumerary teeth usually produce irregularities of the alveolar arch and often affect the palatal arch. The nasal cavities may or may not be altered. This depends largely upon the extent of the oral change. Mosher<sup>34</sup> believes these irregularities in the eruption of the teeth and their faulty occlusion explains fully half of the cases of asymmetry of the hard palate. He is also of the opinion that non-shrinkage of the premaxillae is a cause of the high arch.

Since the blood and nerve supply comes largely through bony foramina, D. Braden Kyle<sup>35</sup> queries if this supply may not be insufficient for proper development if the size of the foramina is affected by injury or malformations.

Certain habits, such as thumb-sucking, biting the lower lip and holding the tongue between the upper and lower incisors have also been considered factors in deforming the growing jaw.

From the foregoing varied opinions it is evident that the etiology of nasal and dental irregularities and their interrelation is still indefinite. I believe, however, that we can safely conclude that prenatal influences tend to produce in certain individuals a narrow head with associated narrow nose and jaws, and that postnatal influences may interfere with the normal development of the nose and jaw, producing irregularities in one or both.

The interrelation and the ratio one bears to the other is undetermined as yet.

The indications for treatment in the acquired cases are very clear. First, correct any abnormality, either growth or deformity, interfering with nasal respiration.

Second, have an orthodontist expand the palatal arch and produce normal occlusion.

The treatment of a patient with a congenital narrow face is quite another problem, as here one is usually obliged to sacrifice normal tissue to establish perfect nasal breathing.

If the statement so often made be true, that the widening of the palatal arch widens the nasal cavities, then the indications would be to expand the arch, which would enlarge the



nose and establish in the majority of cases normal respiration unless the pharyngeal tonsil be enlarged. Some orthodontists even claim that nasal obstruction from "adenoid growth" will be relieved by palatal expansion.

The uncertainty of the effect of palatal expansion upon the nasal fossa and the inability to understand how the nose could be widened by such a procedure, led me to make intranasal measurements with the object of proving or disproving such assertions.

These measurements were made with internal calipers between the inner surfaces of the inferior turbinates, a little posterior to their anterior third, after the mucous membrane of these bodies had been shrunk with cocain and adrenalin.

Measurements were made on several individuals at different times until it was found that the average variation was about one millimeter.

For more than a year I used a simple form of calipers, determining the distance by applying them to a millimeter measure. Then I had Meyrowitz make me a form of calipers (turbino-meter) which would record while in position the distance the instrument was placed in the nose as well as the distance between the turbinates. This has not been of any advantage over the simpler form. I use Myles' nasal speculum, one blade in each nostril, to expose the two turbinates.

During the two years that I have been making these measurements, I have been able to follow only two cases where palatal expansion was accomplished. One, male, 21 years of age, consulted me April, 1907, for difficulty in nasal breathing.

He has been more or less of a mouth breather for many years. On examination I found that his alae were flat, dilator muscles only partly developed, the septum nearly straight, the turbinates normal, but the cavity on each side of the septum was very narrow. No pharyngeal tonsil, and only a remnant of the faucial tonsils. The palatal arch was high, and alveolar arch narrow. Moderate irregularity of the teeth of the upper jaw, with malocclusion. Face of the narrow type, with prominent thin nose.

As the nasal cavity could not be made larger without the sacrifice of normal tissue, and as the alveolar arch was narrow, I advised him to have the arch widened, and if nasal respiration was not improved, then resort to nasal surgery.

Dr. Nesbett, of New Bedford, began to widen this patient's arch the first of May, 1907, and completed the widening after the third month. Jackson's spring wire appliance was used for the expansion, and a similar device for retaining same. Pressure was increased about every ten days.

Measurements showed an expansion of  $10\frac{1}{2}$  mm. between 2nd bicuspid,  $9\frac{1}{2}$  mm. between 1st molars, and  $5\frac{1}{2}$  mm. between 2nd molars. The distance between the inner surfaces of the two inferior turbinates, after the mucous membrane had been shrunk with cocain and adrenalin was 14 mm. at the time expansion was begun. Five months later, two months after expansion had been stopped, the distance between the turbinates was 17 mm., an interturbinal widening of 3 mm. Five months later, a few months after the retaining appliance had been removed, the measurement was still the same.

The patient is now able to breathe very well through the nose, and does not need intranasal interference. He has gained eighteen pounds in weight.

Model 1 was made when expansion was begun, model 2 when expansion was completed, and model 3 was recently made. These models show very clearly the change that has taken place in the mouth.

My other patient is a male 19 years of age, who consulted me February, 1908, on account of difficulty in breathing through the nose. On examination the septum was found deviated to a moderate degree. The turbinates were nearly normal. The pharyngeal tonsil had been removed some years previously without improvement. Remnant of faucial tonsils. His alveolar arch was narrow, palatal arch high, teeth moderately irregular and the so-called "open bite."

Knowing that the teeth should be attended to at once and remembering the results of my above reported patient, I advised having the regulating attended to first, and if necessary intranasal work later. After several months time he consulted Dr. Rogers of Boston, who reports to me as follows: "This extreme type of malocclusion has had several factors in its development: general neglect in the care of the teeth during early childhood, improper nasal breathing; and habits of the thumb and tongue. The thoughtless dentist has his share also, because he extracted the first and second molars on the right side of the lower jaw. To obtain and retain proper occlusion is difficult in this case."

Oral treatment was started May, 1908, at which time model 4 was made. Model 5 represents the condition of the mouth six months later.

Intranasal measurements made May, 1908, showed a distance of  $11\frac{1}{2}$  mm. between the inner surfaces of the lower turbinates, November, 1908, six months after palatal expansion and dental regulation had been in progress, the distance had increased to  $13\frac{1}{2}$  mm., an interturbinal widening of 2 mm.\*

Dr. Rogers says the patient will remain under treatment about six months longer, when a fairly accurate result will be obtained.

The patient already notices improvement in breathing.

The first case is a representation of the leptoprosopic type of skull. His father's face is of the narrow type.

The second case is apparently of the acquired type, although his father and one sister have contracted arches with irregularly placed teeth.

Two cases are not a sufficient number from which to deduct definite conclusions, but with the observations of the orthodontists, that nasal breathing becomes normal or is improved after palatal expansion, and reports of cases by the rhinologists, as Black's<sup>30</sup>, there seems to be but little doubt that the conditions of the nose are favorably influenced by the correction of palatal and dental irregularities.

How the apparent widening of the nasal cavities is accomplished is very difficult to explain, especially in the two adult cases reported. A purely mechanical explanation does not seem plausible unless it be in the very young.

By referring to Figures 1 and 2 we find less than one-third the length of the teeth exposed for the application of force. If force were applied to this third and its action were only mechanical, we would first have a tilting of the teeth with their alveolar processes and second a separation of the intermaxillary suture in the young, with possibly a stretching of the palatal bones in the adult, provided there were no external structures to prevent. There is, however, a very strong buttress, made up of the malar and frontal bones, which would prevent any such outward movement, particularly in the adult.

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\*Through the kindness of Dr. Rogers I have been able to-day (November 29, 1909) to measure the distance between the two turbinates, which was found to be 16 mm., an interturbinal widening of  $4\frac{1}{2}$  mm.



An examination of Figure 2 only, which is a section made through the roots of the second molar, would seem to disprove this statement were it not for the fact that this apparently very weak structure extends forward but a short distance. In this region of the second and third molar, expansion is rarely needed.

Figure 1 more nearly represents the region where expansion is required, and the structures that would oppose any purely mechanical force.

The skilled orthodontist tilts the teeth and their processes but little if any and never separates the intermaxillary suture unless intentionally. It is, therefore, evident that mechanics alone do not explain the widening.

To illustrate the absence of tilting and separation of the suture, I would like to show two models of a patient of Dr. Rogers.

Model 6 represents the upper arch of a boy twelve years of age, showing lack of growth. There is a history of "adenoid growth" and a septal spur. Both defects were removed about the eleventh year, with no special improvement noticeable in the nasal respiration after the operation.

Model 7 represents the same arch about eighteen months later. Dr. Rogers says: "This case cannot fail to impress one with the immense amount of development which has taken place under the stimulation of properly applied appliances. During the treatment a gradual improvement in nasal respiration was noticed."

Measurements taken high up in the vault of the arch of the first model opposite the bicuspid teeth and at the same place on the other, indicate very conclusively that the teeth have not been tipped and the apices have not remained in their former position but have been carried far beyond. The approximation of the central incisors proves that the intermaxillary suture was not separated.

If the vault of the palatal arch is widened by expansion of the alveolar arch, as is so well shown in models 6 and 7, and less so in 1, 2, 4 and 5, is it not reasonable to infer that the floor of the nose must also be widened? Clinical observations at least serve to confirm this, and my measurements add evidence toward a proof.

The most reasonable explanation of these changes, it seems



to me, is that the application of force to the teeth stimulates growth of the bony tissue of the alveolar arch, palate and nose.

To show, in another way, the influence slight pressure has upon bony formation I have made a cast of the face of one of my patients, who is a boy about 17 years old. He has had, according to his statement, interference with nasal breathing for several years. Examination showed both nasal cavities filled with polypi, filling in the cleft between the septum and outer wall of the nose. These soft structures have stimulated to growth the nasal process of the maxillary and nasal bones.

If such soft tissues can alter the shape of these firm nasal bones, is it not reasonable to suppose a more definite force, as that used by the orthodontist, can also alter the shape of the palatal bones, and consequently the lower part of the nasal cavities?

#### CONCLUSIONS.

1. Palatal and dental irregularities are usually associated with imperfect nasal respiration, which they may cause or be caused by.

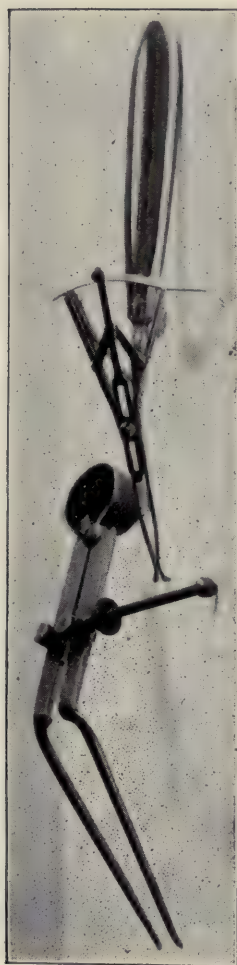
2. Intranasal measurements contribute evidence toward the proof that widening of the palatal arch widens the nasal cavities.

I wish to acknowledge my indebtedness to Drs. Nesbett and Rogers for their help and advice.

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CALIPERS.







MODEL 1.

MODEL 2.

MODEL 3.





MODEL 4.

MODEL 5.







FIGURE 1.



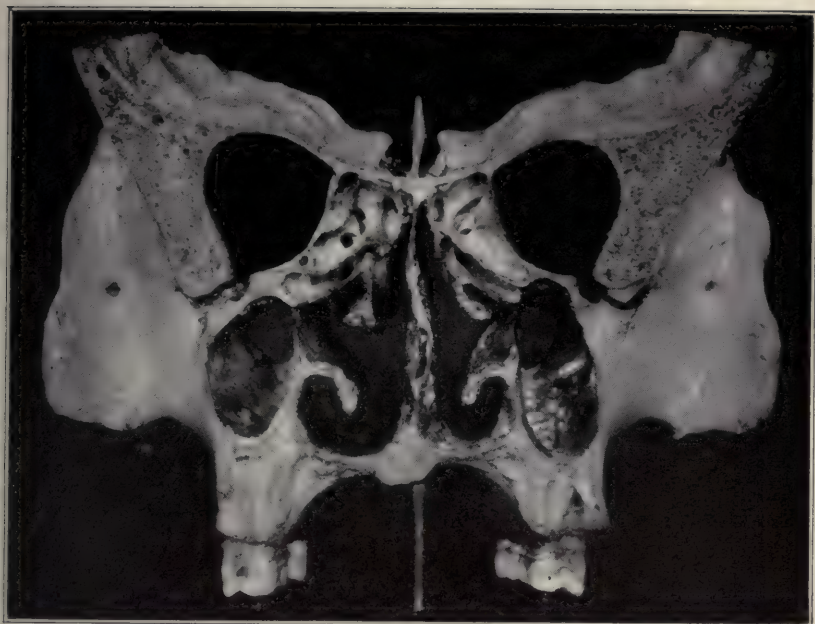
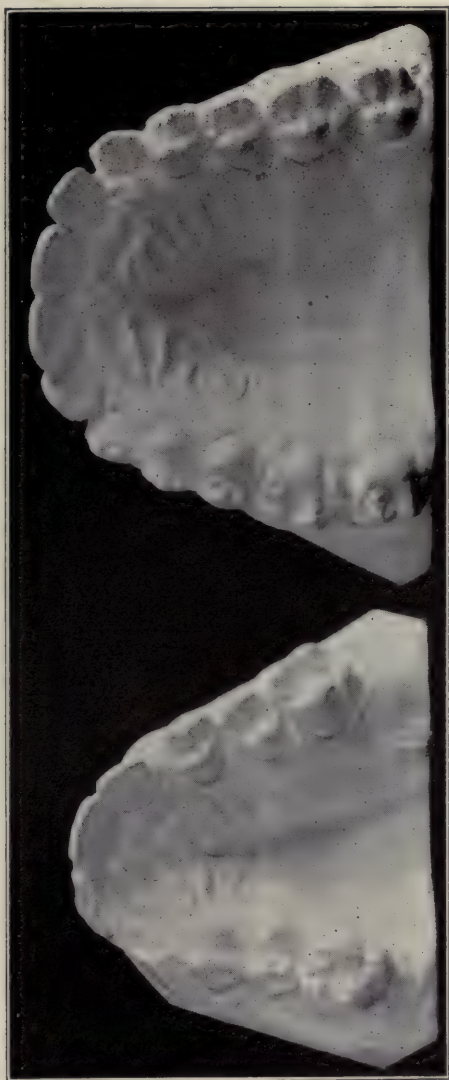


FIGURE 2.







MODEL 6.

MODEL 7.





CAST OF FACE.





## XII.

### SINUS THROMBOSIS OF OTITIC ORIGIN AND ITS RELATION TO STREPTOCOCCEMIA.\*

BY EMIL GRUENING, M. D.,

NEW YORK.

The streptococcus group stands out preeminently among the various microorganisms causing purulent inflammation of the middle ear. Recent studies on the bacteriology of acute affections of the middle ear show that they are due in more than fifty per cent of the cases to the presence of streptococcus pyogenes, and in about fifteen per cent to streptococcus mucosus. Leutert, Suepfle, and E. Libman, of the pathologic laboratory of Mt. Sinai Hospital, report identical results. It seems then that the pneumococcus and the staphylococcus do not play as important a rôle in the causation of purulent middle ear disease as has formerly been assigned to them. Still, these organisms are frequently demonstrable, as are also a number of other bacteria in either pure or mixed cultures.

One of the most dreaded complications arising in the course of purulent middle ear disease, thrombosis of the lateral sinus, is most frequently associated with a general systemic infection. Blood cultures taken from patients thus infected, show that the cause of the systemic disorder is again the streptococcus which circulates freely in the blood.

In the last ten cases of thrombosis of the lateral sinus occurring in the otologic service of Mt. Sinai Hospital, the blood cultures were made under the supervision of Dr. E. Libman. The blood used in these cultures was taken from the median vein before and after ligation of the internal jugular vein. The blood culture reports of these ten cases, received from the pathologic department, are positive in seven cases, neg-

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\*From the New York Medical Journal, June 5, 1909, republished in the Annals by request of members of the section.

ative in three. The microorganisms causing the infection were, in five cases the streptococcus pyogenes, in one case streptococcus mucosus, in another the bacillus proteus. The same organisms had previously been found in the purulent discharge of the ear. As stated before, the internal jugular vein was ligated in all these cases. Of the ten cases here grouped together, eight patients recovered and two died. One death occurred from meningitis in a case the blood of which was reported negative, and the second death took place in the case infected by the bacillus proteus. These observations go to prove that blood taken from the veins of the arm will demonstrate the presence of the microorganisms in the general circulation more convincingly than the blood taken directly from the sinus. Leutert has advocated the latter method to indicate the presence of a thrombus. Furthermore do the clinical data prove that the presence of the streptococcus in the blood does not necessarily lead to a fatal issue, but on the contrary, provided the internal jugular is ligated, permits of a favorable prognosis.

I have selected of this group of ten cases, the last two, with positive blood findings, as examples of what the course of the disease may be under different conditions. In the first case we must assume that the formation of new foci had already begun before ligation of the jugular. In the second, the thrombosed sinus was the only focus and this was disposed of by ligation of the jugular and removal of the thrombus.

CASE 1. L. H., a schoolboy, ten and a half years old, was admitted to the ear wards of Mt. Sinai Hospital on March 31, 1908.

Present Illness: Twelve days ago he began to complain of severe pain in the left ear, with headache, fever, and marked prostration. Severe pain in the left ear continued, together with high fever. For the past four days he had daily shaking chills lasting fifteen minutes and followed by marked sweating. He also vomited repeatedly during the last four or five days, and the contents of the stomach were ejected with considerable force. He was very drowsy during the last few days, and two days ago seemed delirious. Bowels moved three to four times daily, loose and watery. No convulsions. The chief complaints were: Pain in ear, headache, high fever and chills,

projectile vomiting, diarrhea, marked prostration, lethargy, and slight cough.

**Physical Examination:** The child remained quiet in a lethargic state, but answered questions. Lungs were clear, except for an occasional sibilant sound, especially in the left interscapular region. Slight dullness in left supraclavicular fossa. Pulse was equal, regular, small, soft, with fair force. Abdomen was slightly distended, no rigidity, no definite point of tenderness. There was no Kernig sign, no Babinsky reflex. In the right ear the drumhead was red and bulging, and the mastoid process was very tender. In the left ear the drumhead was also bulging; there was marked tenderness on pressure over the antrum, the tip, and also the postmastoid region. In the neck there was a decided distension of the left superficial veins; marked tenderness along the course of the internal jugular vein on left side.

The ophthalmoscopic examination was negative. Temperature 105.4° F., pulse 100, respiration 28. White blood corpuscles count was 11,200; polymorphonuclear count 86 per cent.

**Operation:** The drumheads were incised and pus was obtained from both tympanic cavities. Pus contained streptococcus pyogenes. The next day, April 1st, the operation on the left mastoid was performed in the usual manner. The antrum and mastoid cells were full of pus, the sinus plate was softened, and therefore removed. It was found that the sinus wall had sloughed, and pus was oozing from the interior of the sinus. No flow of blood from sinus. At this juncture it was deemed necessary to expose the internal jugular vein. It was found diseased in its whole course from the jugular foramen to the clavicle, and was excised. The sinus plate was then cut with long forceps until the jugular foramen was nearly reached. There was still a small bridge of bone covering the jugular bulb. This was also removed with the forceps. The jugular bulb lay before us containing a disintegrated clot. The anterior wall of the sigmoid and lateral sinus to a distance half way between the upper knee and the torcular were then removed until free hemorrhage was obtained from the peripheral end of the sinus. And now the sinus and the bulb had been converted into a groove in which the softened grey thrombi lay. All these were removed. The operation on the



bulb was done in accordance with Grunert's method. There was no difficulty in the removal of the bridge, and the transverse process of the first cervical vertebra was not in the way.

While the patient was on the table the pathologist drew blood from the median vein for the purposes of a blood culture. The report we obtained from the pathologist was that the blood contained the streptococcus pyogenes. The thrombi of the sinus and the jugular and the pus of the mastoid all contained the streptococcus.

April 2nd. Postoperative condition was rather poor. Pulse 148, respiration 38, temperature 107.2° F. An intravenous infusion was made as the temperature dropped over twelve degrees in the next four hours, from 107.2° to 95° F. The temperature remained at 95° F. several hours, then rose to 96° F., at which point it remained stationary a little while, and then rose in one straight line with a chill to 106.4° F. The blood culture made at this stage was negative, showing that the focus had been thoroughly dealt with.

April 4th. The last two days the temperature ranged between 99° and 104° F. No chills. There was a profuse discharge from the right ear and tenderness over the right mastoid. There was also a marked edema over the whole scalp. Patient was restless, vomited bilious fluid, complained of pain in the right inguinal region and right knee. The temperature rose again to 106° F., and the streptococcus reappeared in the blood. White blood corpuscles count, 20,000, polymorphonuclear count eighty-nine per cent, lymphocytes ten per cent, eosinophiles one per cent. On the same day an operation was performed on the right mastoid. The antrum and the mastoid cells contained pus. The sinus plate was removed and one inch of the sinus exposed. It was soft, blue, and appeared normal.

While the patient was on the table and under the influence of the anesthetic the wound on the left side was dressed. The wound looked clean. No purulent discharge. It was found that a disintegrated clot plugged the peripheral end of the lateral sinus. The bone over the latter was removed and the sinus wall incised. The plug was dislodged and free bleeding followed.

April 9th. In the past three days the temperatures ranged between 99° and 103° F., pulse between 80 and 100, respira-



tion 24. An abscess appeared on the outer aspect of the middle of the right thigh. It contained about three ounces of yellowish, frothy pus. Pathologic report, streptococcus. The mastoid and cervical wounds were dressed and looked well.

April 11th. Temperature ranged between 99° to 102.8° F. Over the occipital region an area about the size of a silver dollar was infected and sloughing, showing bare bone.

April 13th. There was a swelling of the right knee joint with distinct fluctuation above and below the patella. The right knee was immobilized with a starch bandage.

April 16th. In the inspection of the wound on this day it was noted that there were some granulations in the sinus grooves. Pus in both antra. The wounds were washed with hydrogen peroxide and salt solution, and sprayed with a three per cent carbolic acid solution. Dry dressing applied. The right knee joint was distended and markedly tender. Three days later, on

April 20th, Dr. Lilienthal, one of the surgeons of Mt. Sinai Hospital, aspirated the right knee, and evacuated a large amount of thick pus. He then applied a compression bandage and immobilized the knee. A few days later a large swelling appeared on the posterior aspect of both arms. They were large intramuscular abscesses from which about six ounces of pus were removed. On

May 1st the following notes were made: "There is a moderate purulent discharge from the wounds in the arms and in the right thigh. Mastoid wounds and wounds in neck are clean and granulating. Pressure sore on scalp shows granulations completely covering bone. Still some fluid in knee joint. General condition fairly good. Lungs and heart negative. Blood culture sterile." On

May 3rd when the temperature did not rise above 100° F. the patient began to complain of pain in the perineum. He continued to complain of this pain, and a large, hard, nodular mass presented itself on the left side of the perineum. On

May 9th Dr. Lilienthal was kind enough to see the patient for me, and operated upon him by incising and draining the abscess in the perineum, and also incising and draining an abscess in the suprapubic region. On

May 25th the boy was discharged from the hospital with all

his wounds closed, with good hearing, and a movable knee joint.

CASE 2. Mrs. R. R., thirty years of age, was admitted to Mt. Sinai Hospital on October 16, 1908.

Present History: Four weeks ago she had a severe cold in the head. About one week later she suffered with acute pain in the right ear, headache, and fever. This lasted about two weeks, when the ear began to discharge. The discharge was slight and the pain in the ear continued. In the past three or four days the discharge ceased, and the patient had several chills. Pain in the ear became very intense, and radiated to the parietal and occipital regions. The throat at the right side was very painful inside and out. Temperature on admission 103.4° F., respiration 30, pulse 120. White blood corpuscles count, 22,800; polynuclear, ninety-four per cent; lymphocytes, six per cent. Her chief complaints were: Pain in right ear and mastoid region, severe headache, fever and chills, pain in upper right neck, deafness of right ear, and drowsiness.

Local Physical Examination: There was a marked tenderness over the right mastoid from the antrum to the tip and over the postmastoid region. There was also decided tenderness over the upper part of the internal jugular vein. There was no redness or edema anywhere, only pain on pressure. The right auditory canal was decidedly narrowed by swelling of its walls and by sagging of the posterosuperior wall. The drum membrane was congested in its upper part and bulged outward. In its lower part there was a small opening through which pus exuded.

General Physical Examination: Patient looked very sick. There was a strong tendency toward drowsiness, patient closing the eyes and apparently sleeping as soon as she was left undisturbed. She could easily be aroused and kept awake, but when left alone soon returned to the former state. The pupils were small and equal, and reacted to light and with normal accommodation. Examinations of lungs and heart were negative. Pulses equal, rapid, of good force and quality, knee jerks active and equal, no Kernig sign, clonus, no Babinski reflexes.

Operation October 16th: Paracentesis having been performed, the usual postauricular curved incision with posterior prolongation was made. The cortex was hard, and after its

removal a number of cells were exposed filled with recent granulations. The antrum contained pus. No sinus plate could be found. The anterior wall of the sigmoid sinus was entirely destroyed, and the sinus itself filled with a black clot, in which there were white streaks. After all diseased bone had been removed and the antrum thoroughly curetted, a portion of the lateral sinus was exposed and found to be normal. The mastoid wound was now temporarily packed, and attention directed to the internal jugular vein. This was identified with some difficulty, as the lower two-thirds was grey in color and apparently collapsed. The silk ligature was placed about the vein a little above its juncture with the subclavian. In dissecting the internal jugular vein from the adjacent structures a chain of enlarged lymphatic glands was found along the posterior surface, forming a sort of bed for the vein. These were removed. The highest ligature was placed about the vein just above the point of entry of the facial branch, which was also tied off. The jugular vein was then resected. The wound in the neck was then packed with iodoform gauze.

Returning to the mastoid wound, the clots referred to as occupying the opening in the sinus walls were lifted off. With a spoon directed toward the heart a portion of the clot was removed from below, but no bleeding ensued. A second time the spoon was introduced downward, and almost immediately there was a gush of blood from below with dislodgment of a very long clot. It measured more than an inch, was black in color and had white streaks. The wound was immediately packed with iodoform gauze. The segment of a vein from the ligature above the facial branch was apparently not thrombosed, but contained fluid blood. Blood culture from the left arm taken with patient on the table.

Postoperative condition was good. Pulse 128, respiration 32. Report of blood culture showed streptococcus mucosus.

The next day another blood culture was taken, which was negative. The temperature fell to 99° F. and remained so all day. Pulse ranging from 92 to 100, respiration 24.

October 20th. Condition of the patient gradually improved, and on October 22nd, five days after the operation, fever had actually disappeared. Temperature 99° F. The wound was dressed for the first time. The mastoid wounds showed beginning granulation everywhere. They were fresh and healthy.



The patient made an uneventful recovery and was discharged from the hospital in good condition.

In the two cases here minutely related, and in the whole group of the ten cases mentioned, the diagnosis of sinus thrombosis was made from the clinical symptoms alone. The blood culture was not necessary for the corroboration of the diagnosis, but it was important to become acquainted with the relation which sinus thrombosis bears to systemic infection. This relation once established will assist us in the proper appreciation of the obscurer cases in which the clinical data are insufficient for the recognition of thrombosis of the sinus.

That a positive blood culture can be advantageously used as important evidence of the presence of a thrombus has been repeatedly demonstrated at Mt. Sinai Hospital. Patients who, after a thorough mastoid operation, did not do well, and whose temperature remained high, though the accessible part of the sinus appeared healthy, improved immediately upon ligation of the jugular, which was thought advisable as the result of a positive blood culture.

We may even go further. In two cases admitted to the medical wards with high fever, systemic infection, and no previous history as to ear trouble, Dr. Libman requested me to examine the ears and lay bare the sinus of the side of the possibly affected ear. He arrived at the diagnosis of sinus thrombosis by the exclusion of other foci in the presence of a positive blood culture. In both these cases the lateral sinus was found thrombosed, though with the exception of old perforations of the drum, there were no external evidences of ear disease. The two patients recovered after evacuation of thrombi from the lateral sinus, one with and one without ligation of the jugular.

36 East Fifty-seventh Street.



### XIII.

## A CASE OF RECURRENT MASTOIDITIS WITH INVOLVEMENT OF THE LABYRINTH.

BY HUGH B. BLACKWELL, M. D.,

NEW YORK.

*Previous Aural History.*—Eight years ago this patient underwent a Schwartz operation for the relief of acute mastoiditis in the right mastoid region, one week later a similar operation was performed behind the left ear. After a convalescence extending over one year, both wounds healed, but for every subsequent year since then, they have each broken down and discharged, for periods of several weeks. During these attacks of recurrent mastoiditis there has never been any pain, vertigo, nausea or other subjective symptoms. In the intervals the ears have been perfectly dry.

*Present Aural History.*—For the week prior to December 1st, 1908, patient suffered from a severe coryza, and the left ear began to discharge posteriorly. This ceased inside of one week. In the meantime the old mastoid cicatrix on the right side broke down and commenced to discharge, together with discharge from the canal. About the same time the patient noticed that she had a right side facial paralysis, together with the fact that she became very dizzy on assuming the erect posture, associated with a tendency to fall backwards. The vertigo became so severe that the patient was compelled to go to bed and remain there for the following three weeks, during which time there was no pain or nausea. About December 21st, 1908, she was enabled to get out of bed, as the vertigo was much less severe. After remaining out of bed for one week she came to the infirmary for treatment.

*Examination of the Patient on Admission to Hospital.*—Patient had a moderate degree of paralysis of the right side of her face. There was no nystagmus or vertigo. Patient was whirled upon a revolving stool in both directions, ten times in ten seconds. After each whirling, a lateral nystagmus was

observed, which only lasted from 5 to 7 seconds, and was as marked in looking to the right as to the left.

*Aural Examination, Right.*—In the region of the right mastoid cicatrix there was a discharging sinus, which led down to the antrum, at bottom of which bare bone could be felt. Canal was filled with odorous pus, marked sagging of the posterosuperior wall almost occluded view of drum, which, however, could be seen intact, with no visible perforation. Moderate tip tenderness could be elicited.

*Left Ear* contained some odorous pus, with a posterior perforation of the membrana tympani, the old posterior cicatrix dry.

On January 2d, 1909, patient was admitted to the New York Eye and Ear Infirmary, service of Dr. Lewis, and four days later was operated upon; during this interval, prior to operation, her temperature remained normal.

*Operation.*—A semilunar incision was made in the line of the old cicatrix, and the Schwartz cavity scraped free of granulation tissue. A portion of the bony floor of the middle fossa was found to be diseased. This was removed, revealing the underlying dura, very much congested, and presenting several flakes of fibrinous deposit on the surface. The bony floor was still further removed until healthy dura was exposed. The sinus, which had been evidently exposed in the previous operation, was also uncovered. Over a small area, in the vertical limb, on its wall at that point, were several flakes of fibrinous deposit. The overlying bone was removed until healthy sinus was exposed. After removing the granulation tissue from the antrum, the entire cap of the horizontal external semicircular canal was found to be absent, and from either extremity of the canal were fistulæ leading into the internal ear. The posterior canal wall was then taken down and the tympanum scraped free of ossicles and granulation tissue. The facial nerve was then seen to be exposed for a distance of from one-eighth to one-fourth of an inch in the tympanum, and attached to its under surface at this point was a mass of dark granulation tissue. This was gently removed. There was then observed a large dehiscence in the outer vestibular wall, just beneath the anterior extremity of the horizontal semicircular canal, which included the oval window. The stapes was missing. The canal system was next exenterated by means of a

chisel and gouge, and the vestibule entered through the solid angle. The bony bridge between the oval and round windows was next broken down by a chisel placed in front of the facial nerve and the vestibule freely opened, it was found to contain a large mass of black granulation tissue, smears from which showed great numbers of streptococcus capsulatus organisms. The facial nerve now extended as an intact band devoid of any bony support, across the posterior portion of the tympanic cavity to the stylomastoid foramin. The gouge was next placed upon the promontory, and the outer wall of the lower half of the first turn of the cochlea was removed at one stroke. As the interior appeared normal, no more of its structure was removed. A meatal flap was cut and sutured back to the temporal fascia, and the operation completed in the usual fashion, save that the posterior wound was left open.

For four days after the operation the patient had a marked lateral nystagmus. It was equally pronounced in both directions. On the fifth day the nystagmus became more marked, upon looking towards the well side, but continued to diminish from this time on. The temperature ranged between 99° and 101° F. for the first ten days, and did not return to normal until fourteen days after the operation.

At the first dressing there was observed a small dark spot, on the under anterior aspect of the facial nerve, the point of the former tympanic exposure. There was some fear lest the nerve would slough through at this place. It may be that a part of its substance was lost, but most of it remained intact. During and after the first dressing, vaseline was placed in the cavity to protect the nerve as far as possible.

Since the operation the patient has not been dizzy. She refers all forks to the left ear. There is no air conduction for either forks or whispered speech, in the right ear. Whether there is bone conduction or not, it is difficult to say. I think that she probably hears the fork with the left ear. Since the operation, the nystagmus, as produced by whirling, is about the same in looking in either direction, and lasts from four to five seconds.

On syringing the recently operated ear with hot and cold water there is no nystagmus reaction in either direction. On syringing the sound, or left, ear with cold water there was observed a marked nystagmus when patient looks to the right. This is reversed when hot water is used.

Assuming that the symptoms from which the patient complained during the first three weeks of December, were the initial indications of the labyrinthine invasion, it is an interesting fact that the left or normal labyrinth had, within a period of two weeks after the destruction of the right canal system, undergone a complete functional compensation, entirely restoring the patient's equilibrium.

The performance of the operation during this quiescent period suggests the advisability of delaying any surgical procedure, in these cases, upon the internal ear, until all symptoms of acute labyrinthine disturbance have subsided. It being well known that practically all of the phenomena of acute labyrinthitis are capable of production, by either irritation or disease of the middle ear, without there existing any actual bacterial infection of the internal ear itself.

148 West 58th Street.



#### XIV.

### SINUS THROMBOSIS, CELLULITIS OF THE FOOT AND ACUTE INFLAMMATION OF THE THYROID CARTILAGE.

By T. L. SAUNDERS, M. D.,

NEW YORK.

The following case occurred in the service of Dr. G. Bacon, at the New York Eye and Ear Infirmary, to whom I wish to express my appreciation for allowing me to report it and for the benefit of his advice and ripe experience in solving the problem that it afforded.

The patient, a colored girl of about 21, unmarried, and an actress by occupation, was admitted to the New York Eye and Ear Infirmary, on December 10, 1908, with the diagnosis: Otitis media suppurativa chronica. Mastoiditis left. Otitis media suppurativa chronica right. Temperature, 99.6°; pulse 94; respiration 20. Briefly her story was as follows:

Usual diseases of childhood. Previous history negative, save for an occasional attack of cystitis and leucorrhea. Has had running ears ever since she can remember. For the past four weeks has suffered from pain in the left ear, which has gradually grown worse, and for the past two weeks has prevented her from sleeping at night. In the last two days has vomited several times. No chills; thinks she has had some fever.

*Physical Examination.*—Left middle ear filled with granulation tissue; remnant of drum at upper part; profuse creamy foul discharge issuing from the auditory canal. Slight tenderness over mastoid, antrum and over top. Right ear shows some granulation tissue; drum at upper part. Very slight foul discharge. No malarial tendencies. Patient rather dull, apathetic; looks sick; tongue heavily coated. Otherwise negative. Blood count, December 11th, day after admission, white cells 7,800; polynuclears 76.6 per cent; urine, negative.

On December 12, 1908, pain, tenderness and discharge per-

sisting, the radical operation was performed. Cortex very thick and eburnated; very few cells. Sinus found encroaching on antrum, there being barely room to enter it. Antrum small. Middle ear filled with necrotic granulations; tegmen tympani and tegmen antri eroded; dura exposed, but normal. After the sinus was accidentally uncovered, an area one-quarter of an inch square, a rather free hemorrhage occurred from the region of the knee. This stopped later, after slight pressure from an iodoform gauze pad. At the time of operation it was thought that a tributary vein had been injured, but in the light of following events the author is compelled to believe that it was the sinus itself. A meatal flap was turned down and sutured; wound packed through canal and postauricular wound. Usual dressing. Patient did well afterward. Temperature,  $99.4^{\circ}$  to  $100.4^{\circ}$  until third day after operation, when temperature rose to  $102^{\circ}$ . Moderate cellulitis around postauricular wound was discovered; stitches removed and wet dressing applied. Temperature at once fell to  $99.6^{\circ}$  and then ran from  $100^{\circ}$  to  $100.6^{\circ}$ . On the sixth day after operation, temperature rose to  $101.4^{\circ}$ . On the seventh day, December 19th, it suddenly rose from  $100^{\circ}$  to  $105.4^{\circ}$ , four hours later to  $106^{\circ}$ . There was no chill, but the patient complained of slight headache, sore throat and pains in the joints. Wound dressed. Looked clean. Some tenderness over both shoulder joints, over knees and ankle joints. Physical examination otherwise negative.

Blood count: White blood cells, 9000; polynuclears, 86 per cent; no malaria found. Temperature,  $106^{\circ}$ ; pulse, 128; respiration, 38. Convulsion starting in face, then arms and legs; rigidity; no loss of consciousness.

December 20th, eighth day after operation, temperature again rose to  $106.3^{\circ}$ , falling to  $102^{\circ}$ . General condition good. Sore throat more marked; difficulty in opening jaws and swallowing; profuse mucopurulent tenacious expectoration; extreme tenderness over both sides of thyroid cartilage. Tonsils and pharyngeal walls not apparently inflamed. On account of difficulty in opening jaws, a laryngeal examination could not be made. Tenderness in shoulders and knees has disappeared and has become localized in right tarsus. Some swelling.

On the following day tenderness over thyroid still marked. A large amount of tenacious mucopurulent secretion removed

from the region of the base of tongue and epiglottis, after which patient could open mouth sufficiently to permit a laryngeal examination for the first time. Uvula red and edematous; tonsils red; epiglottis fiery red and edematous; vocal cords could not be seen owing to general congestion and swelling. A smear of the mucopus from the throat showed spirillum of Vincent, streptococci and staphylococci. Patient's general condition very good.

On December 22d, tenth day after first operation, the patient for the first time felt chilly, and the temperature rose to  $105^{\circ}$ . As the throat condition and swelling in the foot seemed better, it was decided to explore the sinus.

Blood count: White blood cells, 30,000; polynuclears, 74.4 per cent.

*Second Operation* (Dr. Bacon in consultation).—Primary wound enlarged by posterior incision. Cortex over sinus removed with chisel and rongeur for about one and one-half inches. Sinus wall apparently normal, no pulsation seen, no clot felt. Opened with knife, firm clot present. Slight flow obtained from bulb and after curettage. A shining black clot two inches long extracted from torcular end, followed by free flow of blood. On account of joint symptoms persisting, it was decided to excise jugular vein. Vein excised from clavicle to facial. Vein evidently normal, not collapsed. No enlarged glands in neck. Wound drained and partially sutured. Patient left table in considerable shock. Temperature fell next day to  $100.8^{\circ}$ , rising again to  $103^{\circ}$ , and from then on, 101 to 103, occasionally rising to  $104.4^{\circ}$ . Pain in tarsus continues, swelling more marked. Mastoid and jugular wounds doing well. Patient beginning to look septic, but does not run pyemic temperature. No chills, no sweats. Physical examination, negative.

On December 30th, eight days after second operation: White blood cells, 25,000; polynuclears, 82.2 per cent.

On January 2d, ten days after second operation, swelling and tenderness marked over dorsum of right foot. X-ray, negative. Exploratory aspiration, negative. Blood culture taken, negative. From this time on, patient's general condition began to improve, but foot became worse. Operation advised, but refused by patient finally.

On January 10, under chloroform, three incisions were made

over dorsum of foot; evacuation, about a cupful of dirty brown pus and necrotic material. Tendons exposed, but not invaded. Pus found to contain streptococci in long chains. About this time the patient complained of a vaginal discharge. This was also found to contain the spirillum of Vincent in large numbers.

The interesting points in the case are these: Throat symptoms obscuring diagnosis. Sinus thrombosis manifesting itself clinically at least seventh day after operation. Inflammatory focus in foot appearing one day after sudden rise in temperature. Nature of process: Embolic more than septic. Negative blood culture.



## XV.

### THE AFTER-TREATMENT OF OPERATED ACCESSORY NASAL CAVITIES.\*

(FROM THE ROYAL UNIVERSITY POLIKLINIK FOR EAR, NOSE, AND THROAT DISEASES. BONN, GERMANY. DIRECTOR, GEH. MED.-RAT. PROF. DR. WALB.)

BY HENRY HORN, M. D.,

SAN FRANCISCO.

The territory covered by the title of this paper is so great that only a small portion of it will be selected for discussion. The pith of the entire subject is contained in the answer to the following question: Why does the after-treatment of the Killian operation cover a period of several weeks, when in a radically operated, isolated empyema of the frontal sinus or the antrum of Highmore, practically no after-treatment is required?

The answer is simple. In the case of the isolated empyema, the collection of pus, with its accompanying pyogenic membrane, can be radically and entirely removed, and, while a natural and at the same time sufficient drainage is always present, the cure is a permanent one.

Since Reichel in 1907, at a meeting of the German Otological Society,<sup>1</sup> reported a series of 60 Killian operations, there has not been published any other work in which important changes in the operation or after-treatment have been suggested.

One cannot tell with certainty what the immediate future holds, but from our standpoint of today, it is difficult to see how the principles which underlie the Killian operation can be changed. An improvement in certain details is possible. If, for example, one could suggest how the anterior wall of

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\*Paper read at the annual meeting of the German Laryngological Association, held in Freiburg, June, 1909. Translated by the author.

the frontal sinus could be retained, without sacrificing any of the present successful results or the gradually increasing freedom from recurrences, we might, on purely cosmetic grounds, adopt the suggestion. It is in this very connection that I wish to offer a hint, the usefulness of which you must prove for yourselves. If by any means one could secure an absolutely satisfactory drainage from the beginning of the after-treatment until a complete cure is reached, we could allow the anterior wall to remain. This drainage can be secured by negative pressure!

From a technical standpoint, the retention of the anterior wall offers no difficulties. If by means of a Roentgen photograph we find the sinus small and uncomplicated, a radical curettage from beneath the bridge or a Ritter's operation,<sup>2</sup> is easily carried out. If, however, a large sinus is present, then any one of the well-known osteoplastic methods can be used. It is, however, not my intention to suggest any improvements in the operation itself, but only to enunciate a principle whereby the length of the after-treatment can be decidedly shortened.

The following conclusions are based on the results of 24 radical operations on the frontal sinus and ethmoid labyrinth, all of which, except for unimportant modifications of my own, were carried out according to the method of Killian. The very short time limit does not admit of detailed case histories, and they will be later published in full. Briefly stated, then, in 11 cases, 10 to 14 days were necessary for a complete cure; in 6 cases, only 5 to 8 days; in 3 cases, the after-treatment covered a period of 3 weeks, and in the remaining 4 cases a much longer time was required. The reasons for this delay in the healing will be discussed later, and here it is only necessary to remark that it did not in any way depend on the method used in the after-treatment.

As far as I know, I have for the first time, in this series of cases, employed the principle of negative pressure as a means of securing permanent drainage from the time of the removal of the drainage material to the completion of the cure. As "completely cured," only those cases were considered, in which, during a period of six months to one year following the operation, the headaches did not return, where by inspection no pus was to be seen, or with a suction pressure

of 16 to 18 centimeters of mercury, no pus could be demonstrated as coming from the operated areas.

No one, I think, can disagree with the statement that the best results are to be expected from the Killian operation:

1. When by means of preliminary operative measures, all polyps, bullæ, easily accessible anterior ethmoid cells and enlarged middle turbinate are removed, and diseased conditions of the antrum of Highmore and the sphenoid sinus are cured.

2. When the operation is carried out in an absolutely radical manner so that not a single diseased ethmoid cell or a square millimeter of thickened frontal sinus mucous membrane remains behind.

3. When by repeated daily suction treatments, with proper pressure, the operated territory is kept free from secretion from the beginning of the after-treatment to the end of the cure.

If these prerequisites are carried out, we can confidently expect a cure inside of 14 days.

It is, however, perhaps advisable that the patient, as after a radical mastoid operation, be kept constantly under control, and where possible a re-examination be made every few months. In this way the beginning of trouble can be discovered and small granulations can be removed. In many cases, on account of an acute cold, the drainage becomes suspended and must be renewed. I am also convinced, and the opinion is shared by others, that the carrying out of this artificial drainage by suction has a distinct retarding effect on the tendency of the drainage opening to close. Exactly as is the case after a sphenoid sinus operation, the drainage opening has a tendency to close concentrically and build at the lowest point a connective tissue barrier over which the flow of secretions is hindered.

Even in cases treated by this method, where there is no trace of granulations in the region of the drainage openings, the natural position is so unfavorable that an acute cold with retention of the secretion can bring about a relapse. My first case, for example, a pansinusitis combined with ozena, was discharged healed at the end of 57 days. The outlook for a lasting result was, on account of the ozena, very poor. I heard that three months later, as a result of an acute cold, a relapse occurred, which necessitated repeated operations on the frontal sinus and ethmoid labyrinth!

If, after daily treatment for from two to three weeks, we are able with suction to demonstrate only a few drops of pus, which can be proved not to have its origin in the mucous membrane of the nose, then a second operation is not to be avoided, and one will without question find the cause in some overlooked diseased ethmoid cell. Diseased structures not removed at the operation can never be cured by suction treatment.

In a former paper, "Ueber Saugbehandlung bei Erkrankungen der Nebenhöhlen der Nase,"<sup>3</sup> was reported not only the beginning of my experiments in the after-treatment of the Killian operation, then only six cases, but also the value of the method of measured negative pressure in diseases of the accessory cavities in general and its value as a diagnostic and therapeutic agent.

It seems unnecessary to remark that when by means of the Killian operation, the disease of the accessory cavities is cured, this does not necessarily imply that the accompanying disease of the nasal mucous membrane will be cured as well. In order, however, to make this point clear, I will again repeat, that if the three preliminary requirements for a successful operation have been fulfilled; if the operation has been radically and properly performed; if the after-treatment has been properly carried out, and we then still have secretion, the cause for the trouble lies not in the operation or the after-treatment, but in some secretory disturbance of the nasal mucous membrane itself.

And just here are we in a position, by means of the method about to be described, to at any time determine, whether any given case is really cured or not, and whether the secretion arises from the operated accessory cavities, the unoperated accessory cavities, or the nasal mucous membrane itself.

Our failures are always found in those cases where an accessory cavity disease is combined with an *ozena*. In spite of a properly carried out operation, the after-treatment drags along from week to week, the nose secretes daily a large amount of mucus, which is usually found on the floor of the nose, and the exact origin of which is hard to determine. The method of determining the source of the trouble is as follows:

1. By means of an irrigation, the antrum is shown to be free from secretion.



2. The drainage openings of the sphenoid sinus and the operated territory are firmly tamponed with small pledgets of cotton.

3. A thin layer of aristol is blown over the nasal mucous membrane.

At intervals of a few hours the nose is now carefully examined. If a secretory mucous membrane disease is the cause of the trouble, the aristol will be seen raised on a thin layer of mucus. If now no mucus is seen, and, after removing the cotton plug from the operated territory but not from the sphenoid opening, suction shows a collection of mucus pus, then the newly formed lining of the operated territory is at fault, or some hidden diseased area was left behind at the time of the operation.

Before I turn to a consideration of the method of using negative pressure as an assistance in the after-treatment of operated accessory cavities, I wish to call attention to the apparatus itself. As you see by Figure 1, the nose suction apparatus consists of three parts, the nose piece, the pump, and the manometer for determining the amount of negative pressure used.

The nose piece<sup>4</sup> (Fig. 2) is entirely of glass, and is easily cleaned and sterilized. The part which closes the nostril has the shape of an olive and thus fits every nose. At the air outlet you see a small glass tube projecting into the interior, which prevents all secretion from entering into the rubber tube and thus the pump. The nose piece is roomy and rests on a flat bottom, thus allowing it to be conveniently placed to one side for purposes of comparison or examination.

It is not necessary to enter into a detailed description of the manometer, except to call attention to the protection chamber on the right, which is connected with the same by a movable glass joint, and held in place by two springs. This protection chamber is for various reasons of considerable importance, especially if one is using a water-jet pump, for when the water is suddenly turned off, the water backs up and would otherwise overflow the manometer.

In the mercury chamber you see a tiny air intake, so arranged as to prevent the quicksilver from being blown out, as was formerly the case in my first models, when one was using a rubber ball or poorly constructed pump.

Any method, except the uncertain rubber ball, can be used for the suction. The ordinary Bier's metal suction pump is perhaps the handiest and always to be depended upon. Since Strauss and later Martens recommended the ordinary laboratory water-jet pump for use in this connection, I have tried it and found it very satisfactory. Especially can such a pump be used in hospital and clinical work, where many patients are to be treated. It has an additional advantage in that the patient can carry out the treatment without the presence of the physician.

The method of using the apparatus is extremely simple. The olive end of the nose-piece is placed lightly but firmly into the nostril, care being taken that the opening is not closed by the mucous membrane of the septum or the inferior turbinate. The wing of the other nostril is held closed with the finger, as is shown in Figure 3. The patient now sings a loud, continuous "eeeeeeeeeeeeeeeeeeee," by means of which the soft palate is raised and the nose, together with the nasopharynx, becomes a closed cavity. At the same time, the pump is quickly brought into action, care being taken with a new patient not to exceed 4 to 5 centimeters' pressure or prolong the suction for more than 10 to 15 seconds. In the following treatments the pressure can be gradually raised, but never high enough to become disagreeable to the patient.

The exact method which I used in the after-treatment of my Killian operations was as follows: On the third day the gauze strip or rubber drain was removed. On the fourth or fifth day, depending on conditions, one commences very carefully with the suction. One uses a pressure at the first treatment of 6 to 8 centimeters for a period of 15 to 25 seconds. If mucopus and no blood appears, one can increase the pressure on the following day to 12 centimeters. Higher than 18 centimeters is never necessary. Usually the secretion is at its height on the fifth to sixth day, and then rapidly diminishes, so that in favorable cases, on the eighth day the nose is entirely dry.

In closing, I wish to again repeat the conclusions which the experiments and operative work have allowed me to make:

1. By means of negative pressure, the duration of the after-treatment of the Killian and other operations on the ethmoid labyrinth is undoubtedly shortened.

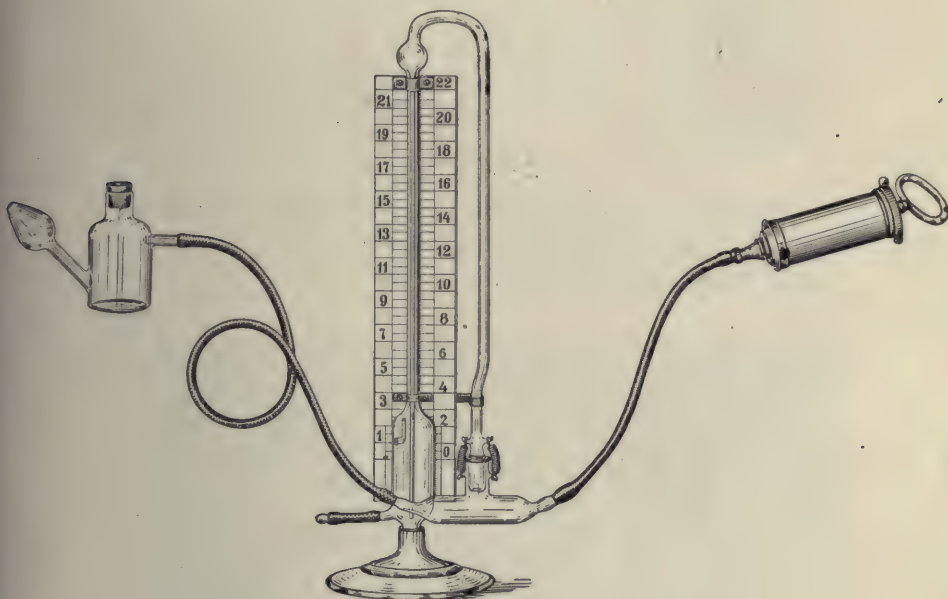


FIGURE 1

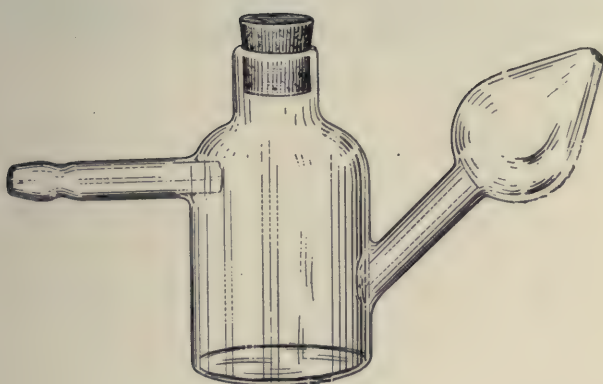


FIGURE 2.

2. By this method we can at any time determine whether a case is really cured or not.

3. The artificial drainage of the accessory cavities, by means of negative pressure, is, according to my experience, a distinct advantage in the after-treatment of this class of cases.

203 Post Street.

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FIGURE 3.



## XVI.

### LATEST ADVANCES IN THE STUDY OF TINNITUS AURIUM.\*

By D. BRYSON DELAVAN, M. D.,

NEW YORK.

Amid the din of the battle against suppurative diseases of the ear the voice of tinnitus aurium seems to have been almost lost. The recent attempt of the Section in Laryngology of the British Medical Association to revive an interest in this most important subject is, to say the least, praiseworthy. It has seemed desirable that your attention should be called to it, and to that end I ask the privilege of offering a brief report of what was said.

The discussion held in Belfast upon the 27th of July, 1909, was opened by Dr. Thomas Barr, of Glasgow, and by Mr. Richard Lake, of London, Dr. Barr's paper dealing solely with the non-operative treatment of tinnitus, while Mr. Lake considered the operative measures applicable to some of the conditions which might be its cause. It is needless to say that the paper of Dr. Barr was a masterly review of the subject, with special reference to methods of treatment in vogue at the present time.

He assumed at the outset that tinnitus aurium was merely a symptom, the effective treatment of which must depend on a correct knowledge of the conditions underlying it. Hence, thorough examination of the organ of hearing by all the subjective and objective methods is a primary essential.

Since tinnitus might be due to a variety of causes, some of them located in the middle ear, some in the external ear, and some outside of either, it was necessary that a careful examination should be made in every direction in which a cause might possibly be found. Thus, disturbances of digestion, abnormal conditions of the heart and of the circulation and of other organs are sometimes the real etiologic factors. The influence of anemia must also be recognized, while neurasthenic conditions might be either a cause or an effect.

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\* Read before the Section in Otology, New York Academy of Medicine, November 12, 1909.

After brief reference to cases dependent on accumulation of wax, eustachian obstruction, removable fluids in the tympanum and other conditions in which tinnitus could be readily cured or relieved by well-known methods, the author passed to the consideration of those cases where tinnitus persists after ordinary methods of treatment have been exhausted, or where no definite lesion can be shown by objective examination to exist in the ear. In this connection, he emphasized the importance of attention to the general health and the influence of coexisting disease, as also that of mental attitude, personal habits and climate. He then discussed external applications, largely in accordance with the methods described in his well-known hand book and familiar to you all.

In tinnitus associated with otosclerosis, or with new formation of connective tissue in the tympanic cavity, or with auditory nerve involvement, whether intralabyrinthial or intracranial, the prognosis is unfavorable, and the treatment should be general rather than local. With regard to the administration of drugs, thyosinamine had sometimes been found helpful, but not uniformly so. The administration of phosphorus had not been tried in England, but from what could be learned of the effects of its use by others, Dr. Barr did not consider that its results were promising. Quinin and hydriodic acid were not recommended, while the salicylate of soda was of doubtful benefit. Alcohol, unless in very small quantities, was, of course, contraindicated. He had found distinct advantage from the use of bromid of ammonium, or of hydrobromic acid, combined with strychnin and arsenic. The iodid of potassium had been thought by some to check the early progress of otosclerosis, while pilocarpine was of distinct value in suitable cases of labyrinthine disturbance. Electrical treatment has proved ineffective and seemed to have been abandoned. The use of vesication, if applied early, occasionally gave good results. Vibration was also sometimes helpful, but the effect was bad if it called the patient's attention unduly to the ear. With regard to pneumatic massage, its value had not been proved, while the noise of the machine was a distinct objection. The tuning-fork treatment had not proved of lasting benefit.

In the discussion which followed the paper of Dr. Barr, Dr. Knowles Renshaw referred to the value of thyosinamine and



recommended that it be administered in 10% solution of water with 20% of glycerine and in doses of from 5 to 30 minims. The existence of arteriosclerosis was a contraindication for the use of this drug. He suggested the danger of the use of fibrolysin in cases of old ulcer of the stomach.

Dr. Logan Turner, of Glasgow, spoke favorably of injections of fibrolysin made directly into the labyrinth.

Dr. Andrew Wyllie advocated the method of treatment by which hot air was injected through the eustachian tube at a temperature of 120 Fahrenheit, and he presented an apparatus for the purpose. It was suggested that Lermoyez had reported that the hot-air treatment was not as popular with him now as formerly.

Dr. Ward Cousins called attention to the evil of over-polytizerization. He believed gentle chloroform inflations good in some cases.

The treatment of tinnitus aurium by operative measures was considered by Mr. Richard Lake, of London, in an able and very interesting paper. He referred first to what might be called remote operative measures, in the form of intranasal treatment, lumbar puncture, and ligation of the carotid artery. He afterwards traced the gradual evolution of the course of operative interference from simple removal of one or more of the ossicles or of removal or separation of adhesions, and the like, and the opening of the perforation of the labyrinth, to the complete ablation of the latter and to division of the auditory nerve. He believed that any fixation of the stapes contraindicated operative interference and that removal of the ossicles was the best and the safest operation. He dwelt upon the subject of lumbar puncture at some length and stated that in the light of his knowledge and experience in the use of this particular operation, it was one of too serious a nature to be recklessly considered and recommended. The question of division of the auditory nerve was also presented and discussed by him with much care. He had collected the histories of eight cases upon which this operation had been performed. Of these, four died, apparently as a consequence of the operation, two succeeded and two failed.

In the discussion of this paper, Dr. Ward Cousins expressed the belief that in cases of tinnitus which were not amenable to

other forms of treatment, operative work would be our future hope, and this would include division of the auditory nerve.

Dr. Delavan referred to the work of Sexton and of Orne Green in the United States and expressed regret that it had not met with wider appreciation.

In summing up the discussion, Dr. Barr called attention to the fact that it had been impossible under existing circumstances to bring forward more than a resumé of knowledge already known, and he ended with the significant and distressing statement that, as a matter of fact, no substantial advance had been made with regard to the treatment of tinnitus aurium in the last twenty-five years.

Were any apology needed for my appearance here this evening, the above assertion, coming from the source that it did, would amply justify my effort to stimulate the interest of the profession in one of the most disastrous afflictions that can befall mankind.

SOCIETY PROCEEDINGS.  
NEW YORK ACADEMY OF MEDICINE.  
SECTION ON OTOTOLOGY.

*Regular Meeting, February 12, 1909.*

DR. ROBT. LEWIS, JR., CHAIRMAN.

**Case of Cerebellar Abscess.**

DR. J. D. RICHARDS. A report of this case was given at the Eastern Section of the Laryngological, Rhinological and Otological Society, two years ago, in Providence, so I will simply cite the earlier features and call attention to a few points in the case which were not dwelt upon at that time. The history was that of an ordinary chronic suppuration from the middle ear, for which a radical operation was done. Three weeks intervened, and then intracranial symptoms for the first time developed. He had vomiting, dizziness, severe headache, no optic neuritis, pulse 50, temperature subnormal, 97.5°. He was then reoperated upon, and an epidural abscess was evacuated. The temporosphenoidal lobe was explored, with negative results. After this, the patient improved for two days, when papillitis developed, with a train of symptoms which pointed to complications in the cerebellar lobe—marked drowsiness, irritability, inaccurate answers, and there was intense headache over the entire left head, chiefly frontal. The temperature rose to 102.6°; pulse from 72 to 140 per minute; both pupils were dilated; there was double optic neuritis, and marked nystagmus—oscillations most marked when turned from the involved side, and also marked when turned to the involved side; the palate of the left half was paralyzed so that the uvula was directed to the right. There was complete facial paralysis, but this came on seven days subsequent to the original radical operation. The patellar reflex on the left side was absent, and on the right side was diminished, but present, and both biceps and ankle jerk were observed on the right side. Plantar flexion on the right; no clonic or neuro-tactile spasms. No aphasia, no anesthesia, and position sense was good. There was no coordination. When he attempted to touch anything with the left forefinger his hand would pursue a deviating

course and touch anywhere. When attempting to touch with the right forefinger the disturbance was not so marked. There was no pain on percussing the skull. These were the conditions which led to the diagnosis of cerebellar condition, and appeared subsequently to the operation on the temporosphenoidal lobe, which had been done a few days before, so that there was a better basis when the cerebellar condition was operated for than had existed previously. The abscess was found by making an incision through the dura, corresponding to the posterior antral wall. The abscess was half an inch below the surface, and a considerable quantity of thin fetid pus was evacuated. A second incision was made, an inch and a half behind, vertically, and the two tracts met. Upon the evacuation of the cavity, the pulse was decidedly accelerated, but the respirations were not noticeably diminished or increased. On the day following, there was a marked diminution in the size of both pupils, and a marked improvement in both coordination and general appearance. The further history of the case is not of special interest.

The points which were not referred to in this report and which I hope will bring out some discussion are, first, the headache. It was intense, confined to the left half of the head, and more particularly to the frontal region. The association of the frontal headache with cerebellar abscess is more than a coincidence. It is too common, and instead of misleading us, it points more to that than otherwise—not that it is characteristic of it, but the association is very common. The second point in reference to the headache was that it was very violent. In the cases of cerebellar abscess that I have seen personally, the headache is more violent than in abscess of the temporosphenoidal lobe. It is more excruciating, and when we remember that headache and optic neuritis are common effects of pressure, it agrees with the fact that the papillitis first attained its greatest perfection, and then the cerebellar abscess and headache attained their greatest degree of intensity.

Next, the choked disk. On August 3d there was no choked disk, on the 5th there was definite papillitis. That shows that the eyes should be examined every day when intracranial involvement is suspected. I had one case in which one day there was no optic neuritis, and in twenty-four hours it was very definite.

Another point is that subsequently the patient developed a



considerable degree of neuritis distributed over the temporal half of the fundus, and one of the surgeons said that he could find no trace whatever of any previous pathologic condition. The diminution in vision in this case was not proportionate to the pathologic appearance of the fundus. We see cases with 5, 6, or 7 diopters of choking, and yet when the vision clears up, the diminution is not proportioned to the pathologic changes seen.

Next, the nystagmus was marked, and was seen in both extreme lateral positions, also the upper median, and was most marked towards the healthy side. The same condition is still present—not marked, but it can be seen when the patient looks to the extreme right and left lateral positions. It is claimed by some that the nystagmus of cerebellar abscess is characteristic. That is not true. Nystagmus in these cases cannot be differentiated from that due to labyrinthine disease, and even if, as claimed by some, the nystagmus is greater when directed to the side of the lesion, it does not serve to differentiate it. You can see a definite nystagmus when this patient looks in either direction.

Then the facial paralysis which came on seven days subsequent to the primary operation. At the time of the operation it was not present. We are inclined to look upon these post-operative paralyses lightly, but this one has not cleared up. That shows we may get a comparatively permanent facial paralysis, even when the nerve is not injured.

The fifth point is the choice of anesthetic. I am against the giving of ether in cases where there is increase of intracranial tension. If we examine the brain of an alcoholic who has died from a debauch, we see the condition of the cerebellar structure, and when we give ether, it puts him on the same path—it gives too much congestion. I have seen two cases of cerebellar abscess where ether was given, in which suspension of respiration occurred—one complete suspension of respiration, and in the other a tracheotomy was done in order to facilitate artificial respiration. When there is a hole in the skull we might feel that the giving of ether might not produce intracranial tension. It is not the intracranial tension, but it is the edema of the tissues of the brain, I think, which causes the suspension of respiration, and the hole does not lessen that.

Next, with reference to the instruments used for explora-

tory purposes. The knives we use might be improved. They are better than a grooved director, but I had one case of meningitis in which there was some question as to whether cerebellar involvement had taken place, and as the patient was practically beyond hope, it was decided to find out whether we had overlooked that, and three punctures were made into the left cerebellar lobe, and the patient succumbed very quickly, and with quite a rise of temperature, just as is seen in pontine hemorrhage. It seemed probable that I had been the responsible immediate cause of the patient's death. We can have a knife that is not necessarily so sharp, and not use that one to cut the dura with, but use a separate knife for that. If a brain is put under a spigot and the white and gray matter washed out, it is difficult to see how we can explore it without cutting the vessels, yet we rarely see a hemorrhage following the track of the knife.

The area occupied by these abscesses constituted one-half of the left cerebellar lateral lobe, and it was two inches from the surface of the dura to the inner wall of the abscess cavity. Recovery from cerebellar abscess is very infrequent; temporo-sphenoidal abscesses give much better statistics.

There are several points in connection with the use of the encephaloscope which illustrate some of the disadvantages of that instrument. The location of the abscess was such that the encephaloscope could not be used. If we attempted to insert it through the opening in the dura, just back of the posterior antral wall, it could not be done; and if we attempted to insert it through an opening in the dura at that point, we were bound to force the axis of the instrument too far inward. You have to make an opening in the lateral aspect, and so follow the track of invasion; if you do not do that, you have to make an incision through a portion of the brain which is not infected at all. A second point in this connection was that when the encephaloscope was introduced through the lateral opening, pus veiled the obturator, and the instrument was withdrawn and again introduced. When part of the pus cavity is evacuated, we feel that it makes room for the introduction of the instrument again, but that is not correct, because the consistency of the brain is such that when a portion is evacuated it closes down upon the remainder, and when you introduce the obturator you have the same pressure that you had before. When the instrument was finally passed into the

depth of the cavity there was a rush of pus through the anterior opening which could not get through the encephaloscope. That shows the danger of using the encephaloscope where you have but one opening into a cavity, and particularly the temporosphenoidal lobe. A third point in connection with the encephaloscope is that after the abscess is evacuated a number of veins could be seen running across the cavity itself. On taking a bayonet forceps and grasping some of these veins, I could tell from the tension that if I attempted to go through that with the instrument the thin walls of the cavity would be torn. The introduction of the encephaloscope under these conditions is certainly a danger.

The last point in connection with this case is the complete recovery of the patient's equilibrium, which did not take long. He is now a worker upon high buildings and suffers no disturbance of coordination, and the only sign remaining is the nystagmus—a very fine nystagmus is still noticeable in the right or left lateral position.

#### DISCUSSION.

DR. KENEFICK asked if Dr. Richards had fore and aft drainage, and what was the drainage material.

DR. RICHARDS replied in the affirmative. An incision was made in the dura corresponding to the posterior antral wall, an incision leading directly backward from the front of the cerebellum; and then a second one, a half inch behind the middle of the sinus lobe—a second incision leading from that inward, or from before back—practically at right angles. Perforated bone tubes were the instruments of drainage.

DR. KENEFICK asked if Dr. Richards meant perforated bone tubes, and, upon being answered in the affirmative, said that if such results were obtained with them it was certainly very satisfactory. He then asked if they came to the surface of the wound, and if there was any gauze inside of them.

DR. RICHARDS replied that the tubes were perfectly stiff, came to the surface of the dura, and had nothing inside—they were practically chicken-bone tubes. They were obtained from a firm in the city, but he had shortened them to suit the length of the tract.

DR. KENEFICK said that this opened up a new method of drainage. Much has been said recently by those who have reported cases advocating the use of some soft substance as the



best drain for these abscess cavities, but it would seem, after all, that success can be obtained with a stiff bone tube, and it is worth while trying to insert it into the cavity of the abscess without injuring the brain tissue.

DR. RICHARDS answered in the affirmative, in reply to a query as to whether the tubes were gradually shortened. The anterior tract was the most inaccessible, and the anterior tube was the shorter, for in order to get it through the tract, the same difficulties existed that interfered with the use of the encephaloscope, and a short instrument or a short tube is required, for the canal interferes, the soft tissues interfere. The anterior opening when the pus became lessened was allowed to close first, and the anterior tube was gradually shortened, and when it was completely taken out, the increased discharge was watched for through the posterior opening, and, finding none, it was taken for granted that no pocket had been overlooked.

Replying to Dr. Kenefick's inquiry about having the advantage of gravity in drainage, Dr. Richards said that he had the advantage of two openings; just as in any abscess, anywhere, it will drain better with two openings than with one. There was nothing new in using perforated bone tubes—that was the proceeding originally advocated by McEwen.

DR. KENEFICK said that he understood it was not much used in this country.

DR. RICHARDS said that he knew nothing about that.

DR. RAE said that the question of drainage was a very interesting one, and inquired if Dr. Richards had considered decalcified bone.

DR. RICHARDS replied in the affirmative and said that it was practically like rubber. The question of drainage in brain abscesses presents the greatest difficulty. He has had much trouble with rubber tubes, and has tried repeatedly to get decalcified chicken bone, but had never succeeded yet. McEwen used originally decalcified chicken bone.

DR. KENEFICK inquired about the size of the cavity, and the amount of discharge.

DR. RICHARDS said that a considerable quantity of pus was discharged, but he could not state the exact amount. The cavity occupied practically the anterior half of the left lateral lobe. As he introduced the probe through the posterior opening later, he could detect that the posterior extremity of the cavity was behind the external opening.



DR. COBURN said that from the point of view of the ophthalmologist the choked disk was the interesting feature. Dr. Richards had spoken of the damage to the sight in these cases. That does not so much depend upon the amount of the swelling as upon the length of time that the swelling continues. Decompression operations benefit the sight only when they are performed early. When they are performed late the secondary changes are so grave that the nerve tissue is destroyed. In these cases there is frequently found apparently good vision, even during the height of the choked disk, and then marked diminution after the swelling has gone down. The vision may be normal in the early part of the attack, and later may be diminished, because of the compression of the nerve fibers by the swollen tissues; even when the patient recovers and the swelling subsides, vision is temporarily restored, but is again diminished by contraction of the new-formed connective tissue. This visual impairment is permanent. In acute cases the choked disk is of comparatively little consequence, except for diagnosis, for these cases are operated early, but where there are chronic abscesses of the brain which are not evacuated, the optic atrophy is apt to cause serious loss of sight.

DR. LEWIS said that he had not had much experience with cerebellar cases, but in one case the headache was very intense and was referred to the forehead. We get these intense headaches in temporosphenoidal abscesses also, especially where the frontal lobe is involved. He recalled two cases in which the headaches were particularly intense. The abscesses were in the anterior portion of the temporosphenoidal lobes.

DR. KENEFICK inquired if Dr. Richards' patient had any seizures before his attack—epileptic seizures, etc.

DR. RICHARDS said he thought not.

#### **Case of Recurrent Mastoiditis With Involvement of the Labyrinth.\***

By H. P. BLACKWELL, M. D.

#### **DISCUSSION.**

DR. RICHARDS said that he saw Dr. Blackwell operate upon this case, and one feature was the one he had just spoken of—the nystagmus just before the operation was the same at one side as on the other. This is the same, as we have just seen, in cerebellar abscesses. There was no hearing prior to

\* See page 155.

operation, for a mass of granulation tissue was taken out. If she did hear, it would be interesting to know how she did with a distinct mass of black granulation occupying the major portion of the vestibular cavity. There was a large dehiscence in the external vestibular wall just above the oval window, and the facial nerve stretched across the cavity like a wire over an open space. If she is correct in what she heard before this operation, it is interesting to know how she did so, particularly a whisper. Dr. Richards said that he did not believe the facial paralysis in this case would ever completely clear up, though it might decrease to a point where it would not be very noticeable, but he had never seen a case where the nerve was completely exposed which cleared up entirely.

DR. BLACKWELL said that he did not test the hearing with a fork before the operation, as the patient was in the clinic and he had no opportunity to do so. He had failed to mention that she refers all forks now to the good ear. The granulation tissue was clinging to the nerve itself and was in intimate association with the nerve, and it was at that point that subsequently the darkened necrotic spot appeared.

**Sinus Thrombosis; Cellulitis of the Foot; and Acute Inflammation of the Thyroid Cartilage.\***

BY T. L. SAUNDERS, M. D.

DISCUSSION.

DR. KENEFICK asked what was the temperature of the patient when on the table for the original operation.

DR. SAUNDERS replied that the temperature was about 99°, but the operation was done on account of the discharge, the intense pain and the persistent mastoid tenderness.

DR. RICHARDS inquired whether the sinus operation was done at the same time as the ligation of the jugular.

DR. SAUNDERS replied that the sinus operation was done first and the ligation of the jugular immediately afterward. The first operation took half an hour, and the jugular twenty-five minutes.

DR. SEYMOUR OPPENHEIMER asked if there was blood culture taken prior to the sinus operation.

DR. SAUNDERS replied no. A blood culture was taken about ten days after the sinus operation because of the condition of

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\* See page 159.

sepsis. It was a question whether or not the condition of the foot was a pyemic manifestation. At that time the blood culture was negative and the streptococcus cellulitis could not be accounted for other than that it was a pyemic manifestation.

DR. OPPENHEIMER said that the cellulitis of the foot was accounted for by its being a metastatic process, and as such one would not find bacteria in the blood, for they would have been shut off by the ligation of the jugular. It would be interesting to know the condition of the blood prior to the operation. The value of this is shown in a recent case. A little boy who had been operated upon for an acute mastoid developed a sinus thrombosis. The blood culture taken at that time was negative, but the clinical evidence of sinus thrombosis was so positive that the sinus operation was performed. Great difficulty was experienced in removing the clot from the bulbar end of the sinus. Blood culture taken on the operating table proved positive, although the day previous the culture was negative. That was due to the fact that in manipulating the jugular some of the infected material was set free and swept into the circulation. Much difficulty was experienced in removing the clot from the bulbar end, and although free bleeding was finally obtained, blood culture taken a day later proved positive again, with general symptoms of pyemia. It was then determined that there was probably a clot still present in the bulbar end of the sinus, and the patient was again put upon the operating table and the jugular bulb exposed, and a thrombosis was found. A subsequent culture, taken twelve hours later, gave a negative result. This winter he had seen three cases of sinus thrombosis with jugular involvement, with decided throat symptoms, though not to the degree shown in this patient. In one case there was an acute tonsillitis coincident with the sinus involvement, in which operation was deferred, with the idea that the symptoms might be due to the acute tonsillitis; but subsequent operation showed that the sinus condition antedated the acute tonsillitis. The throat symptoms were so marked that the question has arisen as to whether or not these throat symptoms are not part of the symptomatology of infective sinus thrombosis.

DR. RICHARDS said that in the case presented by Dr. Saunders, as well as the one referred to by Dr. Oppenheimer, the sequence of events was fairly clear. Coincident with the rise



of temperature there was evidence of metastasis, and he thought the jugular operation should have been done earlier in both cases. There were four intermissions in Dr. Saunders' case, if he remembered the chart correctly, between the initial rise and the time of operation, during which intervals there were symptoms of metastases. The case mentioned by Dr. Oppenheimer illustrates the fact that when you get a sinus thrombosis extending into the bulb the jugular ought to be ligated when you operate—you must not wait, or you will lose your patient. There may be a portion of the bulb below occluded, and there may be a hemorrhage from that source, and it is a bad error to attempt to curette the clot before excising the jugular. The subsequent history illustrates that very plainly, and the evidence for quick operation was plain. One cannot act too quickly in such cases.

DR. RAE said that he had seen a sinus-jugular case within the last few weeks. The patient had had acute follicular tonsillitis and two acute purulent inflammations of both ears. Both drums were incised. Four days later the family physician called Dr. Rae up on the 'phone to say that the ears were much better, but the patient had rheumatism. Dr. Rae said that, of course, he immediately suspected that the rheumatism was pyemic, and had the case taken to the hospital and operated without waiting. A blood culture was taken before operation, but he did not wait for the report. There was streptococcus in the blood, but the patient recovered. The clot in the sinus extended into the bulb. The first evidence of metastasis should make us operate in all these cases, and he agreed with Dr. Richards about curetting into the bulb.

DR. SAUNDERS said that if had another one of these cases he would certainly go into the sinus more quickly, but this one was one of those doubtful cases, in which the throat symptoms were so marked, and in which there was nothing else to indicate the sinus other than high temperature; and he had seen a peritonsillar abscess cause a temperature of 105° and come down, but in the light of this experience he would in future act more quickly. The case had been a very valuable one to him on this account.

#### **A Case of Ulceration of the Sigmoid Sinus With Spontaneous Hemorrhage.**

DR. ROBERT J. LEWIS said that this young man was seen for the first time on the 8th of December. He then had a very



profuse purulent discharge from the ear and all the classical symptoms of acute mastoiditis. The operation revealed a considerable erosion of the inner plate. The sinus was exposed from below the knee to about 2 mm. of the bulb; the sinus was healthy. The patient left the hospital a week later, on the 15th of December. On the 21st of December, during a hard defecation, he felt that the bandage was moist, and on putting his hand to his head he found it (his hand) covered with blood. He came to the hospital the next day, and the dressing was removed, but there was no hemorrhage. A few days later he had another hemorrhage, but not a very severe one. A few days later, while the wound was being dressed, a severe hemorrhage occurred, so severe that the patient almost lost consciousness. The wound was redressed and packed. This was on the 26th of December. The patient was sent to the hospital for observation. On the evening of the 28th of September he had a chill, and then the temperature rose to  $105^{\circ}$ ; the next morning it fell and then again rose to  $105^{\circ}$ ; in the afternoon it again fell and rose. At 4 o'clock the next afternoon he was again operated upon. The wound looked very well and was almost healed, with the exception of a small spot over the knee of the sinus, which looked gray and had not healed. At this operation all the new tissue was removed, and the bone and sinus exposed, all of which looked healthy excepting this one small spot, which had ulcerated through, and from which the blood flowed freely unless controlled by pressure. The sinus was opened and a blood clot was found, not under the point of ulceration, but a half or three-quarters of an inch below it at the bulb. No hemorrhage from the vicinity of the bulb. The neck was opened and the jugular vein excised. No clot was found in it. The neck wound healed in three weeks; the mastoid wound has not as yet completely healed. The patient developed an acute otitis on the other side with mastoiditis, for which a simple mastoid operation was performed. *Streptococcus encapsulatus* was found in the pus smears.

Here was a healthy sinus, in which an ulceration developed after operation, and a thrombus formed, not in the vicinity of the ulceration, but some distance below it, which must be a very rare occurrence. Usually when the sinus ulcerates through the thrombus forms underneath the inflammatory area.

## DISCUSSION.

DR. BRYANT said that he had never seen a case of this kind, but that last summer he had seen a spontaneous hemorrhage from the bulb of the jugular vein in a chronic suppurative case. The patient had previously had five or six rather profuse hemorrhages.

DR. RICHARDS said that he had never seen any case of the kind.

**A Theory of Sound Perception.**

DR. W. SOHIER BRYANT stated that the previous theories of sound perception are not justified by our present anatomic and pathologic knowledge of the labyrinth, and that the study of the ontogeny, phylogeny, and histology of the cochlea gives no indication of the existence of a structure capable of a sound-selecting function. Our knowledge of the development of the cochlea justifies the assumption that the organ of Corti is developed from the pressure organs of the exterior of the body, and perform a similar but more specialized function. The discovery that the tectorial membrane is an artifact of the long hairs of the Corti cells gives an anatomic basis for the author's theory. This theory—the sensitive-hair theory—is, briefly stated: a sound wave after it has been transmitted through the external and middle ear and has entered the scala vestibulæ and scala media, beats upon the sensitive hair band formerly called the tectorial membrane. A sound wave is not analyzed in the cochlea, as is generally supposed. These long, sensitive hairs appear to the author to be the means of transmission of the sound-wave impulses to the neuroepithelial cells. The sound waves pass over these sensitive hairs much the same way as wind passes over a corn field. The motion of the hairs thus caused passes down the hair to the cell which transforms it into a nerve motion and the tone analysis takes place in the higher centers of the brain.

The theory is based on the histologic structure of the neuroepithelial provided with delicate fibrillæ. The next question is: Will this structure fulfill all the acoustic requirements? We find that it will, and for the following reason: Every property of a sound wave is shown in the characteristics of the wave front; these characteristics are variations in the curve of the wave, and we find that they are transmitted in every particular to the hair band.

DR. RICHARDS said that the paper was a very interesting one to him, for it explains a number of phenomena which are not satisfactorily accounted for by the Helmholtz theory.

If you take a cochlea which can perceive a certain range of sounds and fill it up with vaseline, it does not affect it. If the perception is in the membrane or hair cells you cannot hear them as you do.

DR. BRYANT replied that all mutes, who are totally deaf to cochlear, hear to a certain extent by tactile perception. The tactile sense has a wide range of tone perception. An educated deaf mute has a wider range of tactile tone perception than a normal individual. The undifferentiated tactile sense of the body originally perceived all vibratory stimuli. This is now the case with the lowest of the vertebrates, the amphioxus, which has neither eyes nor ears. Man is able to distinguish many sounds with his fingers, irrespective of any bone conduction.

DR. RICHARDS asked how can a patient hear fundamental tones when the cochlea is opened and a large portion removed, which is ordinarily ascribed to perception. When the cavity of the cochlea is filled by the introduction of vaseline, the vibration of the membrane can be perceived. How is it perceived?

DR. BRYANT replied that the explanation is that there is no differentiation of sound in any part of the cochlea, and that if any part of the organ of Corti is functioning, it can respond to all tones alike. He also said that in literature justification could not be found for the assumption that there is any sound-selecting function in the cochlea. The autopsies on patients, whose ante-mortem hearing tests have been recorded, do not justify or prove anything in the way of the sound-selecting function. The chief argument against the theory of the undifferentiated sound perception by the organ of Corti is tone gaps. Dr. Bryant said that his experience was that tone gaps were very evanescent, and depended very much upon the loudness of the tones used in the tests, as well as upon the intelligence of the patient. He said that abnormal perception of tone, pitch and quality was largely a matter of defect of the middle ear sound-transmitting mechanism. This fact is demonstrable in numerous cases. If the theories of sound-selection were true, the defects of tone gaps would be very frequently met with, which fact is not the case. The majority of people are occasionally troubled by having an indisposition



which might possibly alter the mechanism of the sound-selecting organ, thereby causing the patient to interpret notes as either sharp or flat, under these altered conditions; but, actually, we do not observe this change in tone perception.

DR. RAE asked: If that is actually true, why is it that we have pretty well-established tests to determine where the tone is?

DR. BRYANT replied that the usually accepted tests are erroneous.

DR. RAE said that we cannot always explain it.

DR. BRYANT said that, given a non-sound-selecting sensitive neuroepithelium, what part of its function would we expect to give out first? Naturally, it will be the part which was acquired last, and this is the sensitiveness to high tones. If there is any disturbance in the labyrinth, perception of the high notes will, therefore, be lost first. But since the low notes form the other extreme of perception, they will be lost before the notes in the center of the scale. As Dr. Richards says, the findings at operations and autopsies do not justify the assumption that there is a sound-selecting function in the cochlea. The evidence of almost all observers is at present very strong against the theory that the basilar membrane can perform the sound-selecting function.

DR. KENEFICK said that he had nothing to add to the discussion, and felt incapable of doing so, as he was not sufficiently familiar with the subject. Dr. Bryant had spoken of the fact that the character of the sound wave making its influence felt upon the auditory nerve was indicated by its wave curve. That is very interesting, for the character of the sound is reflected, of course, in the wave which it makes. For example: when the sound of the telephone receiver hurts the listening ear it is producing an incision sound wave which is sharp at the apex, and the process of making telephone sounds agreeable to the ear consists in taking off that sharp point, in order that the auditory nerve terminals may be addressed less incisively. The reverse of this process is the principle of most of the electric devices which aid the hearing by intensifying the sound waves. The problem of tone perception, or tone analysis, by the auditory nerve terminals is a very complex one, and Dr. Bryant is to be commended on the lucidity with which he has presented his contentions.



# NEW YORK ACADEMY OF MEDICINE.

## SECTION ON OTOTOLOGY.

*Regular Meeting, March 4, 1909.*

DR. ROBERT LEWIS, JR., CHAIRMAN.

DR. WYETH, PRESIDENT OF THE ACADEMY, IN THE CHAIR.

**Paper: Sinus Thrombosis of Otitic Origin and Its Relation to Streptococcemia.\***

BY EMIL GRUENING, M. D.

### DISCUSSION.

DR. DENCH said that the Section owed Dr. Gruening a debt of gratitude for bringing this subject before them. He himself has had very little experience with blood cultures, although, of course, he has had some experience with cases of sinus thrombosis. He has had 23 cases of sinus thrombosis, in which the internal jugular was excised. Of these, 14 were cured and 9 died: 1 of hemorrhage into the spinal canal, an unusual complication; 1 of general pyemia—(this patient was operated upon late because of a severe pneumonia, which rendered it impossible to operate earlier; he did nicely for three or four weeks, but finally succumbed to general pyemia—streptococci were found in the blood); 3 died of pneumonia, the pneumonia before the jugular was excised; 1 of gangrene of the lung; 1, a young child, died of malnutrition; 1 of hemorrhage into the cerebellum; 1 of gangrene of the neck.

Dr. Gruening had spoken of Gruenert's method of laying open the whole lateral sinus from the sigmoid portion through the bulb to the jugular vein, so as to convert them into one gutter. He had not found them necessary in his cases. In many cases it is possible to inspect the jugular bulb from the lowest portion of the sigmoid sinus, and in the great majority of cases the bulb could be cleared out sufficiently from above. The small segment left between the opening low down in the sigmoid sinus, just above the bulb, and the point where the

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\* See page 147.

jugular was ligated high up in the neck, just below the bulb, was in the great majority of cases insignificant. In a certain small proportion of cases, however, Gruenert's method would be necessary.

He had been much interested in the differential blood count in the cases reported. According to his own experience, the differential blood count had been very unsatisfactory. He had seen a number of cases of sinus thrombosis in which the differential blood count showed no great departure from the normal. In one of the most severe cases the polymorphonuclear count never rose above 81°, and yet in this case there was thrombosis of the internal jugular, with suppuration of the supraclavicular glands. The absence of a high polymorphonuclear count does not necessarily show that there is no clot in the jugular. According to his experience, the differential blood count as a diagnostic measure, in these cases, had been very unsatisfactory.

Dr. Gruening had spoken of ligating the internal jugular through a diseased portion. Dr. Dench had been obliged to do this twice—once in the case of a young child, the patient being so weak that it would have been impossible to have prolonged the operation so as to ligate the innominate, and another in the case of a young adult, who was *in extremis* when placed upon the table, but could not possibly have withstood the operation of ligating the innominate.

In the two cases above mentioned the innominate vein could be seen, but the ligature could not have been passed around it without disarticulation at the sternoclavicular articulation, and this was impossible in these cases, for the reasons mentioned. This should be the operation of election in these cases, where the clot extended through the entire length of the jugular. Gruenert has ligated the innominate on one or two occasions, with success, in these cases.

He was particularly glad to hear what had been said about the tenderness over the internal jugular vein in cases of jugular thrombosis, as it corroborated his own experience. The tenderness, according to his experience, has been in the lymphatic glands and not in the vein itself. He has never been able to feel the cord-like vein, as described by some authors, but there are usually a number of enlarged lymphatic glands over the vein, and these glands are tender. Very fre-

quently these glands must be removed before the vein can be recognized and successfully excised. He regards the enlargement of the lymphatics along the course of the vein as clinical signs of sinus thrombosis, extending into the internal jugular.

The disappearance of the microorganisms from the blood in the cases reported by Dr. Gruening, after ligation of the jugular, is extremely interesting, as it shows that the focus of infection had been cut off from the general circulation. In the case of double mastoiditis, the fact that the germs reappeared when the second ear became involved was of great clinical importance. In Dr. Dench's own case, where the patient died of pyemia, streptococci were found in the blood after excision of the jugular.

As to the value of blood examination, given a doubtful case, the mere fact that there are streptococci in the blood might lead the general physician to have the ear examined, when, otherwise, he might overlook it. Dr. Dench recalled one case, occurring in his practice, previous to the time when blood cultures were thoroughly understood. In this case the total absence of ear symptoms rendered the diagnosis difficult. The diagnosis was finally made on the history of an old aural supuration and the absence of any visible lesion to account for the temperature. On operation a clot was found in the lateral sinus, extending into the jugular vein; the vein was excised and the patient recovered. In this case, undoubtedly, a blood culture would have cleared up the diagnosis prior to operation.

The speaker had been much interested in the case of sinus thrombosis with streptococcemia which recovered without ligation of the jugular. There is no question but that a certain number of cases of sinus thrombosis will recover, even if the jugular is not ligated. It is a difficult question to decide—when to ligate the jugular, and when not to perform the operation. This is a point which no one has as yet been able to decide. Theoretically, it would be wiser to ligate the jugular in every cases of sinus thrombosis, but, practically, this is not necessary.

The speaker then mentioned 48 cases of sinus thrombosis. Also 28 cases of sinus thrombosis in which the jugular was not excised, of which 24 cases were cured and only 4 died. In all of these cases the clot was removed from the sinus by



operative interference, but it was not necessary to interfere with the jugular. These statistics show that in a certain proportion of cases excision of the jugular vein is not necessary to cure sinus thrombosis.

DR. WHITING said he understood the question which the essayist had raised was: Given a suppurating ear and streptococcus in the blood, is one justified in making a diagnosis of a clot in the sinus? That seems to be the sum and substance of the paper.

We know that the streptococcus does exist in a number of diseases in which clots do not form in the sinuses. It is found in fairly considerable numbers in cases of erysipelas, and these patients recover without any clots in the sinuses, so far as we know. We also know that streptococcemia occurs in cases of malignant endocarditis, where patients die, and yet there is no clot; also in cases of sore throat, and the patients recover, and the clots are not found in the veins or sinuses. It does not necessarily follow that because you have streptococcemia you must have clots in the sinus. In his judgment, there have not yet been a sufficient number of cases reported to prove that it necessarily follows. It certainly does not follow in the cases he had mentioned.

In regard to the question as to whether or not a clot is found in the sinus where there is no streptococcemia, the findings of Dr. Gruening would be strongly corroborative of that view. In nine of these cases the streptococcus was found where there was no clot, and in the tenth there was a clot, notwithstanding there was no streptococci in the blood. It would seem from his finding that certainly one can go so far as to say that if one could eliminate from the diagnosis of the patient's condition endocarditis, erysipelas, streptococcic sore throat and other suppurating foci, and if a focus is found in the ear and streptococci are found in the blood, one is justified in looking for a clot in the sinus, for you can be fairly certain that they are getting there from the infected ear. Whether in these circumstances the surgeon would be called upon to tie off the jugular vein in every case, we have not yet sufficient data to know, but certainly the presence of streptococcus in the blood in connection with a suppurating ear is a most significant factor, and should lead us pretty certainly to conclude that it is a wise procedure to tie the jugular vein in such a case.



DR. LIBMAN and DR. CELLER: We have been engaged in the study of infections of otitic origin by means of a blood culture for a period of about ten years. The value of such studies was first made clear to us by a case in which the clinical diagnosis could not be definitely made by the surgeon, and in which the finding of streptococci in the blood led us to believe that it would be wise to explore the mastoid, because no other focus could be found from which the streptococcus might have entered the blood. A sinus thrombosis was found in that case. There has been much difference of opinion among authorities as to the most common infecting organism in acute otitis media. The early authorities considered the pneumococcus the most infecting agent. More recent investigators (Leutert, Funke, Suepfle, Wittmaack) have found the streptococcus most frequently. Hasslauer is the only recent author of prominence who claims that the pneumococcus is the most frequent invading organism. In our study of about 360 cases we have found the streptococcus most frequently, the streptococcus mucosus next most frequently and the pneumococcus in the smallest number of cases. It is to be noted that while the streptococcus mucosus is a streptococcus in morphology, it is more closely allied from a biological standpoint to the pneumococcus.

Notwithstanding the fact that the pneumococcus has been found frequently by many authorities in the middle ear, and notwithstanding the fact that we have found the organism in a certain number of cases, there are hardly any records of sinus thrombosis being due to the pneumococcus. We have not had any case, and the few cases that are cited in the literature are not absolutely proven. It has been shown in our laboratory by Dr. Buerger and Dr. Ryttenberg that the pneumococcus can be so changed by its sojourn in the body that it may be difficult or impossible to differentiate it from a streptococcus. This fact must be taken into consideration, for it might occur that we might find what looked like a streptococcus in a sinus and it might prove to be a changed pneumococcus. Thus far we have not had any such experience. It is well to study this question still further.

One of the main points of interest is the study of the conditions under which bacteria are found in the blood in cases of otitis media, with and without complications. In our ex-

perience we have not found bacteria present in cases of pure otitis media, mastoid disease, extradural abscess or brain abscess. Our positive results have all been in cases of meningitis and of sinus thrombosis. In the cases of sinus thrombosis we have found streptococci most frequently in the blood, occasionally the streptococcus mucosus, and rarely an organism like the proteus bacillus (the last mentioned in very old cases of mastoid disease). In meningitis cases we have found the pneumococcus, streptococcus and streptococcus mucosus. In our more recent studies we have found positive results more frequently in cases of sinus thrombosis than we did formerly, probably because the cultures are being taken earlier.

In some cases of sinus thrombosis the blood culture is negative. We are not yet in a position to explain all the negative results. In some cases the clot itself is sterile and, naturally, then no bacteria are to be found in the circulation. It is possible that in some cases the patient develops an increased bactericidal property of the blood. In other cases pieces of the clot break off, lodge in the lungs, produce abscesses there, and still no bacteria are found in the blood. The pathway in such cases is from the sinus, through the jugular vein, into the heart. This explains a certain number of negative blood cultures. According to our recent studies, the cases in which streptococci were found in the blood after disease of the mastoid had been properly attended to, and when clinical symptoms still persisted, were cases of sinus thrombosis.

Dr. Whiting has pointed out the possibility that one might become confused because of the possibility of the presence of an erysipelas. According to our experience, it is unusual to find streptococci in the blood in cases of erysipelas, and, furthermore, the erysipelas could be recognized and taken into account in explaining the symptomatology in a given case. It is true that in so-called "malignant endocarditis" there are often streptococci in the blood, but that disease is not a primary disease, and if in such a case an otitis media is present, it is very possible that the otitis media is the cause of the infective endocarditis. As far as we know at the present time, as soon as the valves of the heart become infected in a case of general infection from any focus, the patient is generally lost.

The question of possible confusion because of an angina is

a very important one. In our experience we have had no trouble from this source. The cases in which an angina has been the cause of a general streptococcus infection have generally produced distinct local symptoms, and such general infections are not very frequent. Nuernberg, in attempting to avoid the difficulty met with under these conditions, suggested making a blood-culture from the sinus at the time of operation and one from the peripheral veins. If he found more bacteria in the blood of the sinus than in the blood of the peripheral veins, he concluded that the disease of the sinus was the cause of a general infection and not a possible tonsillitis. This method could be tried in cases of suspected sinus thrombosis in which the patient also had tonsillitis. It would be difficult, if there was pus in the neighborhood, to be sure of getting the proper result. In a recent case of sinus thrombosis, in which there was no tonsillitis present, we could not obtain the blood from a peripheral vein, and, therefore, aspirated some from the sinus. It proved negative culturally, and the clot was afterwards found to be a sterile one.

What, according to our experience, is the value of blood cultures at the present time in otologic work? A positive blood-culture result is valuable if there is doubt as to the existence of a sinus thrombosis after the patient has been operated upon for mastoid disease. In most cases the diagnosis is clear enough clinically, but in a certain number of cases in which the mastoid was thoroughly cleared out, and in which there were clinical symptoms still present and which the otologist was not sure that there was still further local disease, the finding of streptococci in the blood has given the indication to explore the sinus, and in all of the cases of this type a sinus thrombosis was found. It occasionally happens that even before the mastoid is operated upon, when the patient has otitis media, the local signs may be insufficient to account for the marked febrile and other general disturbance, and in such a case a positive blood finding may indicate that there is a more serious trouble locally than had been suspected. In a recent case of this kind the patient had a temperature running up to 103° nearly every day and had an otitis media. The otologists did not believe there were sufficient local signs to indicate operation. A blood culture was taken and streptococci found. At operation not only was mastoiditis present, but a clot was



also found in the sigmoid sinus. In that case the jugular vein was not ligated, and the streptococci are still in the blood.

In certain cases, after the sinus has been explored and a clot found, and the jugular vein has not been ligated, the persistence of streptococci in the blood has given the indication to tie the jugular vein. In these cases the streptococci disappeared from the blood very rapidly, with two exceptions; in the one case it was necessary to pack the jugular bulb, and in the other case an infective endocarditis developed, the jugular vein not having been ligated early.

The most valuable field for the blood-culture studies is in border-line cases, in which it is very difficult sometimes to come to any conclusion without the use of blood cultures. The first case of this type which we met was that of a boy who was sent to the hospital for supposed typhoid fever. He had an otitis media on the left side without perforation, and presented slight tenderness of the tip of the mastoid. We took a blood culture, expecting to find typhoid bacilli, but, instead, we found streptococci. The Widal reaction was negative. As there was no other focus that could be found from which the streptococci invaded the system, and as no other cause was found for the fever, it was considered justifiable to explore the mastoid. To our great surprise, a sinus thrombosis was found. After operation the blood was sterile; the boy recovered.

Later a woman was admitted to the hospital with an intermittent fever and large spleen. She had an old otitis media and doubtful signs of mastoid disease. Streptococci were found in the blood, and no focus was found in the body, except the otitis media, from which the streptococci could have entered. She was operated upon, a large thrombus found and she recovered.

On the other hand, there are cases of otitis media, in which the finding of typhoid bacilli in the blood shows that the marked fever and general disturbance are due to typhoid fever, and it is not necessary to presuppose any severe complication of the otitis media.

In some cases it is very difficult to come to a conclusion, unless one judges carefully all the facts in the case. A woman was admitted to the ward with a history of pneumonia for two weeks and a history of otitis media for two days. There was



doubtful evidence of mastoid disease. We found streptococci in her blood and considered it warrantable to advise exploration. A sinus thrombosis was found. If she had had pneumococci in the blood one would have had to remain in doubt, because it would have been more than probable that the pneumococci in the blood came from the diseased lung. Another case had a swelling around the lower jaw for two weeks, with enlargement of the glands in the neck. There was a history that the patient had a paracentesis done two days before, by an otologist who claimed to have found pus. The patient also had an intramuscular abscess in the right calf. In that patient we decided that if we found streptococci in the blood it would be unsafe not to explore the mastoid region. The infections around the jaw are not apt to give a bacteremia. Streptococci were found in the blood, and at operation not only was mastoid disease found, but there was pus in the sinus.

These complicated cases are more apt to be found in large general hospitals.

If the patient has been operated upon for sinus thrombosis and the jugular vein is tied and the bacteria disappear from the blood, it is clear that the entrance of infection to the system has been stopped. A negative blood-culture in these cases is of great value, for it helps us decidedly in excluding an infective endocarditis.

It is interesting to know how quickly the blood gets rid of the bacteria after the clot has been removed, or after the jugular vein has been ligated. In our earlier cases we found that the bacteria disappeared from the blood within forty-eight hours. In the more recent cases we have made our cultures twenty-four hours after operation and found the blood negative in some cases. In one case we found the bacteria had disappeared within eight hours after ligation of the jugular vein. These observations show that in most of these cases the bacteria have been discharged from the local focus and were not multiplying in the blood.

As soon as we get any cases of mastoid disease or otitis media without sinus thrombosis in which streptococci are found in the blood, we shall be very glad to report them. According to our experience, in any local infection, no matter how small, it is possible that bacteria may at any time enter the circulation. We shall continue our studies on the pure

mastoid cases to see how often a streptococcemia occurs. Even if bacteria are found at times, in such cases the indications which we have made would not be materially changed, because we attempt to lay stress mainly on the value of the positive blood-cultures for giving indications of a possible sinus thrombosis in cases in which the mastoid has already been operated upon, and therefore the mastoid can not be blamed for the persistence of the streptococcus.

DR. DUEL stated that his views on this subject had become greatly changed as the result of some investigations made within the past 48 hours, after a discussion with Dr. Jonathan Wright, concerning the recent work he had been doing at the Laboratory of the Manhattan Eye, Ear and Throat Hospital. In view of what he had gathered from this short investigation, he believed that the conclusions reached by Dr. Libman were altogether too sweeping, and that further investigation would teach us not to interpret results of examination of the blood as definitely settled, as he had stated.

Körner collected 314 operated cases of sinus thrombosis, with 180 recoveries, showing an average recovery of 58.3 per cent. According to his statistics, jugular ligation before evacuation of the clot showed a better result than those ligated after its evacuation, or in those cases in which there was no ligation of the jugular. However, this difference did not amount to more than 3 per cent.

Toubert's statistics were of greater value. One hundred cases operated upon within the first week after symptoms of intracranial complication appeared, showed a recovery of 75 per cent, while of 80 cases operated upon more than a week after symptoms of intracranial complications appeared, only 37 per cent, or half the number, recovered. This shows that prompt recognition and early operation have more to do with the results than the particular method of obliterating the sinus. Given, then, a case in which clinical signs of sinus thrombosis appear, where there was no concomitant disease which rendered the diagnosis doubtful, experience had shown that early interference saved a large majority, while delay increased the mortality greatly, and failure to operate was followed by almost certain death.

The cases in which untoward symptoms developed were likely to be those with complications like pneumonia, nephritis,

or tuberculosis, or those having septic throats with accompanying adenitis—as in all the acute exanthemata—and presented problems which none could face, at present, without misgivings as to diagnosis. If a blood culture in such cases could furnish evidence which on the one hand would indicate the necessity of an operation, and on the other, that no operation should be performed, then indeed a great advance has been made, and we could thank the bacteriologist for a diagnostic sign which would undoubtedly save many lives.

Dr. Duel said that when he first heard these cases reported and the claims made by Dr. Libman, he regarded the presence of streptococcemia in a case of suppurative otitis as being of greater diagnostic value than he is able to ascribe to it after a more careful consideration—after reading the results of other investigations and after talking with others interested in this research. He had tried to prevail upon Dr. Wright to attend the meeting to-night and to discuss this subject, but had been unsuccessful. He had, however, a letter from Dr. Wright conveying some views on the subject, which he begged to read:

*"Dear Dr. Duel:*

Referring to our recent conversation, in regard to the interesting claims made by some otologists (that by the detection of a bacteremia, or the presence of streptococci in the blood of the general circulation, it is possible to assert that, in mastoid suppuration, we have, in any given case, to do with a cerebral sinus thrombosis), I send you herewith references to literature, which will disclose considerable evidence that in various infections, some of them very trifling, bacteremia has been revealed by blood culture (and otherwise) in a considerable number of cases.

I also refer you to observations upon latent microbism in various organs which it seems to me have bearings upon the subject.

It is entirely too early to make any positive statement from our own culture work, but from the evidence to which I draw your attention, it would seem prudent to accept the presence of bacteremia in mastoid suppuration as a pathognomonic sign of sinus involvement with considerable reserve.

From all that we are learning of the physicochemical conditions of the blood, from the revelations of direct observations, it seems quite likely that the evidence for the presence, or the



absence, of bacteria in the blood is largely dependent on how much of it can be examined in any given case. It seems also likely that there are states of the system, not betrayed by clinical symptoms, during which bacteria in considerable numbers are carried from one spot to another in the circulation. Inasmuch as bacteremia has been detected in comparatively mild cases of throat inflammations, I think we can hardly afford to postulate the existence of extensive septic thrombi in any case. It seems quite likely, however, that quantitative estimations of the number of bacteria found in a case of suspected sinus thrombosis may be of considerable advantage if a reliable and practical technic can be evolved.

"Very truly yours,

"JONATHAN WRIGHT."

Dr. Wright had cited a number of references which seem to have a very definite bearing upon the question. In *Virchow's Archives*, Fraenkel reports 60 cases "Concerning the Behavior of the Brain in Acute Infectious Diseases." Examinations were made of the blood and brain tissue, and of the vessel walls in cases of a variety of infectious diseases after death, and in a large percentage of these, bacteria were found. In twenty of them, for instance, streptococci were found (in cases of pneumonia, erysipelas, diseases of the joints with pus, and other conditions of that kind); 9 contained staphylococci; 4 staphylococci and streptococci; 6 streptococcus mucosus; 1 Fraenkel's pneumococcus; 5 diphtheria; 6 the typhoid bacillus; 3 the colon bacillus; 4 mixed and other organisms; 1 the proteus, etc.

In another article, the examination of the organs of patients dead of phthisis, within a few hours after death, by Ravenal and Irwin, reported in the third and fourth annual reports of the Phipps' Institute, showed that, among numerous other bacteria, the streptococcus was present in 95 out of 123 cases. One can hardly escape the inference that they and others arrived in the various organs intra vitam by the circulation, owing to disturbances of the system antecedent to death, but the authors do not venture to assert as a result of their frequency in the tissues that the streptococci are often the immediate cause of death in these cases. Leibermeister (Ref. *Centralbl. f. Bakt.*, Bd. xliii, Heft 1-5) could demonstrate in the blood of 30 consumptives t. b. 11 times.



In view of these findings, and also in view of one finding that we have had at the Manhattan Eye, Ear and Throat Hospital, I am inclined to doubt the advisability of accepting the presence of bacteremia in a case with suppurative otitis as sufficient cause for invasion of the sinus, in the absence of some clinical symptoms. We must remember that questionable involvement of the sinus occurred in the very cases in which the ear suppuration resulted from a septic throat in one of the acute exanthemata, tonsillitis, croup, or some allied condition, in all of which the presence of streptococci or some other virulent form of bacteria are known to be present. Even admitting that we might invade the sinus if it were perfectly certain that, with the discharging ear and the presence of bacteremia this were indicated, in the absence of any other cause for bacteremia, we should not be justified in operating in any of these cases known to produce a bacteremia, even when suppurating otitis is not present, without most definite clinical signs in addition.

DR. DUEL supplemented his previous remarks by reporting another case. Within the last two weeks they have been investigating various cases of mastoiditis at the Manhattan Eye, Ear and Throat Hospital by blood cultures taken at the time of the operation, and out of seven examined thus far, one positive case had been found. This occurred in a patient in his own clinic, which was operated upon by Dr. Kerrison. This patient had short chain streptococci in his blood, but no other signs of sinus thrombosis except the presence of the bacteremia.

DR. LIBMAN AND DR. CELLER said: Nothing that has been brought up in the course of the discussion has caused us to change our viewpoint, because we feel that a number of valuable operations were made more certain in their indications by the blood-culture work. There is no doubt that some cases of sinus thrombosis were operated upon sooner than they otherwise would have been. As regards the point that has been brought up regarding the difficulty of estimating the number of bacteria in the blood, there is no difficulty about that point. One has only to make cultures in solid media in plates, besides making the bouillon cultures. The data given by Dr. Duel are of no direct significance in connection with our work, as they are based on reports of studies made after

death. In recent years we have learned that there is very frequently an ante-mortem or post-mortem invasion of bacteria in cases in which there were no bacteria in the blood a few days before death. I have seen cases in which the blood showed no bacteria before death and showed streptococcus six hours after death.

As regards the statement of Dr. Richards about the possibility of having metastases when the bacteria have not been found, such a condition of affairs does at times occur. Those are cases in which the bacteria are distributed early in the disease through the body and then no more are discharged from the local focus. Later on, abscesses form in the places in which the bacteria have been deposited, and not necessarily in all the places at the same time. The mere fact that there were metastases shows that bacteria or bits of infected clot must have been present in the blood at some time.

Many cases of streptococcemia recover, provided you can control the local infection from which the bacteria are entering the body, and provided the heart valves are not involved. The occurrence of a streptococcus in cases of otitic disease in which the mastoid has been thoroughly operated upon and in which general symptoms still persist, gives the indication that there is a local focus that should be controlled. And if you can find no other point from which the infection may be entering, the only place from which you have a right to expect that to come after the mastoid region has been thoroughly exposed is the sinus or jugular bulb. A meningitis which might be causing a bacteremia is easily recognized clinically and by means of lumbar puncture.

One point brought up by Dr. Richards recalls a case in which the streptococcus remained in the blood after the jugular vein was tied. When we reported that streptococci were still present in the blood, the boy was sitting up in bed, but the same evening there was a chill and a rise of temperature. The bulb was cleared out and was packed, and then the boy recovered. This is a very important case showing that in some cases after the jugular vein has been tied, bacteria may enter the blood by way of the petrosal sinus in the manner which Dr. Richards has indicated.

There are two further points to emphasize: The first is that the number of bacteria in the blood gives no indication

of the severity of the local focus in these cases. We have seen very severe cases with very few streptococci in the blood. The other important point is that one must be careful in judging of the significance of a positive result in blood-cultures taken during or directly after an operation on the mastoid. There is always a possibility in these cases that a certain number of bacteria may be forced into the blood current. We have no data concerning such an occurrence in mastoid disease, but we have seen it in operation on other bones. In our experience, thus far, one gets very few organisms in the blood in these cases and the bacteremia disappears rapidly.

DR. DUEL replied that he was not claiming to be a bacteriologist—he knew little about it, but this work was done by Fraenkel, and was reported in the last *Archives*, and the investigations were made immediately after death, according to the report of the article.

DR. KENEFICK, referring to the difficulty of applying these blood-culture tests, told of a case occurring in his service at the Foundling Hospital. The remarks of the evening had been confined to adults, and to cases in which one ear only had been involved, but when cases occur in infants under three years of age, and where there is a complicating pneumonic process in the lung, and where both ears are involved, as Dr. Duel had expressed it, the question of diagnosis becomes a very serious problem. The diagnosis in this case was made post-mortem. An extensive process was found in the lung, with adhesions; there was a primary occluding thrombosis of the jugular bulb extending one-third of the distance to the clavicle, and all the large venous vessels of the brain were thrombosed. The mastoid process was not involved. It was perfectly normal, and he was able to make out a point in the posterior inferior floor of the tympanic cavity through which, he is satisfied, thrombotic extension into the jugular bulb occurred.

He had also had another case of the same age under his care, running a temperature chart exactly similar. The pediatricians were able to eliminate all other causes of high temperature, but although the case ran a similar temperature to the first it recovered after free drainage had been established through both *membrana tympani*. In the first case no blood culture had been made; had this been done, it might have given a hint as to the true condition, although with the pneumonic



condition, operative success was doubtful. In the second case a blood culture was made and was negative.

DR. KOPETZKY said that the conflicting views which had been presented left but little solid ground upon which to stand. Undoubtedly Dr. Libman was correct in saying that we spoke from a limited experience, yet even that experience already gave contradictions in results. This might possibly be due to mistakes in technic, and if there is any diagnostic value in the finding of streptococcemia, it would seem that we should know the correct method of obtaining the pathologic findings. The question as to whether or not streptococci are to be found in the blood in other conditions besides sinus thrombosis is another side of the question, which must be determined beyond a doubt. Up to the present time this is not satisfactorily settled, and until it is, the final diagnostic value of Libman's findings must be accepted with reserve. Furthermore, it appears as if the quantitative estimation of the amount of cocci in the blood must be of value, and as yet no faultless method for such estimation had been proposed. The otologist is not ready as yet to operate on the sinus in cases which present only the finding of bacteria in the blood, unless this is accompanied by other marked symptoms. Even the two cases presented by Dr. Gruening had symptoms distinctly marked for three or four days, and the diagnosis was made by the otologist and not by the pathologist. Again, the cases where there is a bacteremia present in the blood and which recover without opening the sinus, adds another factor toward causing us to hesitate about operating simply on the finding of bacteremia.

DR. CELLER said there is evidently no relation existing between the number of colonies in the blood cultures and the extent of the lesion; as an instance, I might cite a case occurring early in our series in which the blood culture showed four colonies of streptococci in ten cubic centimeters of blood. This case was one in which clinically the diagnosis of sinus thrombosis had not been made. At the time of operation, the lateral sinus was found to be thrombosed. The patient subsequently died, and at post-mortem it was found that the thrombus extended as far as the torcular Herophili.

DR. GRUENING said that the skepticism shown this evening was very salutary and would help to clear the situation. No theory had been propounded, only ten cases of sinus throm-



basis were reported, and these were diagnosticated from the clinical symptoms alone. Blood cultures were made in these cases, and the pathologist found positive results more frequently than negative results. The patients who had streptococci in the blood recovered after ligation of the jugular vein. This is an actual experience, and need not be doubted. Whether with larger material the results will be identical, we do not know.

It has been said in this discussion: If, in ear diseases, the streptococcus is found in the blood, and this is indicative of sinus thrombosis, why may it not be some other sinus that is affected, e. g., the cavernous or the petrosal? The fact is, we know that the lateral sinus is generally affected.

The skeptic attitude is stimulating, but there is also a positive side to this question, which will be strengthened by further experience.

# NEW YORK ACADEMY OF MEDICINE.

## SECTION ON OTOTOLOGY.

*Regular Meeting, April 9, 1909.*

DR. ROBERT LEWIS, JR., CHAIRMAN.

### **A New Instrument for the Inspection of the Posterior Nares, Eustachian Tubes, Pharynx, and Larynx.**

DR. HAROLD HAYS said that all were familiar with the salpingoscope used through the nose, in order to get a view of the Eustachian tubes, but those who have employed this instrument have not been able to get a distinct and definite image. The electric tongue depressor is limited in its capacity, as only the posterior pharyngeal wall and the oral cavity are plainly seen. Some few years ago an instrument for the examination of the Eustachian tubes and posterior nares was devised, but it could not be kept in position so as to give a distinct view. The instrument now presented was devised to obtain a view of the posterior nares and Eustachian tubes, and is based on the principle of the cystoscope.

Heretofore it has been difficult to see adenoids, particularly in children, and to make pathologic examinations of any part of the upper air passages not distinctly in view when the tongue is held down by a depressor. This instrument, called the pharyngoscope, is arranged with a horizontal and vertical shaft, the horizontal part containing the telescopic arrangement in the center, and electric lights on either side at the inner end, the vertical part acting as a handle and containing the wires for connection to a rheostat.

The instrument is inserted in the mouth until the inner end is about one-sixteenth of an inch from the pharyngeal wall. The patient is then told to close his mouth, when the muscles become relaxed. The instrument can be retained in position for ten or fifteen minutes without any gagging. When the instrument is in position, with the lens pointing up, a distinct view of the pharyngeal vault is obtained. By rotating the inner tube or telescope the lens can be so placed as to see any

point desired—the Eustachian tubes, posterior nares, epiglottis, vocal cords, etc. With this little instrument Dr. Hays has been able to examine many pathologic conditions not usually seen—for example, a patient came to the New York Eye and Ear Infirmary, who had been treated for eustachian catarrh. By inserting this instrument, a very definite view was obtained of both eustachian prominences; the left one was perfectly free, but the other was entirely obstructed by a large adenoid growth. In another patient, suffering with chronic middle-ear catarrh, by means of the pharyngoscope small hypertrophied lymphoid follicles were seen around the orifices of the tubes. He has been able to examine the larynx in patients with extremely sensitive throats, who could yet retain the instrument in place for ten or fifteen minutes, allowing a careful examination to be made.

Another application of the instrument is now being worked out, namely, the possibility of catheterizing the eustachian tubes through the mouth instead of through the nose. Catheters on the style of the ureteral catheter will be passed through the instrument in such a way that when they enter the tubes the instrument itself can be withdrawn and the catheter still remain in place. One can thereby pass a sterile catheter through a sterile instrument into the middle ear, without fear of causing infection. The instrument cannot be sterilized by boiling, but, like the cystoscope, must be formalinized.

Dr. Hays showed several pictures of conditions seen through the instrument, and also demonstrated its application on a patient.

DR. FRIDENBERG said that his experience with the instrument was limited, but that it seems to be a very practical one, and is easily used. It would be especially valuable for the examination of the larynx in children. In using the laryngoscope, when the child moves, the mirror has to be taken out and replaced, but with this instrument in place the child can struggle and cry as much as it likes and yet one can get a good view of the throat.

Another point is that the mouth can be kept closed while the instrument is being used. It promises to be a valuable method for studying the normal changes in the larynx during phonation. Still another field of usefulness is the inspection of the posterior nares in cases of suspected sinus disease.

Every one knows how difficult it is to trace the pus and discover its point of origin; but after the nares have been washed out this instrument can be put in place and allowed to remain for five or ten minutes until the pus appears.

It does not give the ordinary laryngoscopic picture; so one is liable to be a little confused until the customary landmarks are found. In the drawing which he had made of the base of the tongue, it seems as though the patient had a marked hypertrophy of the lingual tonsil.

(Demonstration of the appearance of the throat with the instrument.)

The illumination is excellent, and the instrument can be kept in place for quite a long time. It certainly is an exceedingly practical and valuable means of examining the pharynx.

DR. HAYS said that one point of which he had forgotten to speak was the suggestion made by Dr. Fridenberg that it would be a valuable instrument to take to the bedside for the purpose of examining the mouth of an unconscious patient. Also, though the instrument was intended for diagnostic purposes, rather than treatment, yet the patient can hold the instrument and enable the physician to go through a considerable part of the treatment through the nares, and can look at the throat at the same time. Its capabilities and application were being carefully studied, and no doubt many improvements can be made which will increase its usefulness.

#### **Stereoscopic Demonstration of Ear Specimens.**

DR. MARTIN COHEN.

1. Drum membrane, with chain of ossicles—posterior view.
2. Tympanic cavity and labyrinth—view from above.
3. External auditory canal with tympanic membrane and articulation of malleus and incus.
4. Bony labyrinth with aqueductus vestibuli et cochleæ, posterior view.
5. Membranous labyrinth.
6. Opening into antrum.
7. Simple mastoid operation.
8. Radical mastoid operation.

DR. DUEL said that this was a most valuable method of teaching anatomy, as it gives students an exact picture of the



condition, and that one could profitably spend an evening over these pictures.

The object of these stereoscopic slides, which were prepared at the Anatomical Institute in Vienna, is to illustrate respectively the anatomic relations of the various important landmarks of the temporal bone.

If this method of studying anatomy with the stereoscope were employed generally, it would greatly facilitate the comprehension of anatomic relations.

These specimens demonstrate the external, middle and internal, surgical relations of the ear.

**Report of Cases of Herpes Oticus With Remarks on the Syndrome of "The Herpetic Inflammations of the Geniculate Ganglion" and the Zoster Zones of the Auricle.**

DR. J. RAMSAY HUNT reported three cases of herpes oticus with neural complications, and still further elaborated the subject of herpetic inflammations of the geniculate ganglion. (*Journal of Nervous and Medical Diseases*, 1907, 1909, and *Am. Journal of Medical Sciences*, 1908.)

CASE 1.—(Herpetic inflammation of the geniculate ganglion of the VII.) Man, aged 68. Onset August 16, with severe pains in right mastoid region, swelling and tenderness of the auricle. The next day there developed complete facial paralysis on the right side. Sense of taste impaired in right trigeminal area. Tear secretion normal. Four days later a constant tinnitus aurium, followed by deafness in right ear. No vertigo, no nystagmus. An herpetic eruption appeared upon the concha, tragus, antitragus and lobule. (A single large vesicle on the tympanic membrane.)

CASE 2.—(Herpetic inflammation of the jugular ganglion of the vagus).—Man, aged 19, following exposure to cold, had pains in the left ear in conchal region. Four days later developed left facial paralysis. No auditory symptoms. Status praesens: Left facial palsy complete, taste sensation diminished in left trigeminal area; hearing normal; tear secretion increased on the left. A small localized eruption of herpetic vesicles situated in the cleft between the lower half of the auricle and the mastoid process; none within the canal.

CASE 3 (Herpetic inflammation of the jugular ganglion of the vagus).—Girl, aged 18; onset in August, 1907, with pains in the lobule of the left ear and mastoid regions—very sharp

and lancinating in character. On the third day there appeared a small crop of vesicles posteriorly in the cleft between the lobule and the mastoid process. No auditory symptoms, no facial palsy. A severe postherpetic otalgia persisted, that was still manifest in February, 1908. Examination of the ear negative.

The syndrome under discussion is characterized by the general symptoms of zona; an eruption of herpetic vesicles on the cephalic extremity (head, face, ear and neck) in conjunction with facial palsy and auditory symptoms. The eruption may be situated in any of the zoster zones of the cephalic extremity.

Herpes facialis—Gasserian ganglion.

Herpes oticus—Geniculate ganglion of VII and jugular ganglion of X.

Herpes occipito collaris—II, III and IV cervical ganglia.

The neural complications, facial palsy and symptoms referable to the auditory nerve (cochlear and vestibular divisions) may occur singly or in combination with the eruptive manifestations in any of the above mentioned zoster zones. Hence there may be Bell's palsy associated with an eruption of zoster vesicles in any of the cephalic zones, or there may be auditory nerve symptoms in conjunction with an eruption of zoster in the cephalic zone; or both Bell's palsy and auditory disturbances may occur in combination with zoster in the cephalic zone.

When these palsies occur they are to be referred to an herpetic inflammatory process in a geniculate ganglion and the ganglion of the acoustic nerve. It is also possible in some cases that the auditory nerve is involved secondarily by an extension of the inflammatory process along the nerve sheaths in the depths of the internal auditory canal.

Dr. Hunt divides the cases of herpes oticus into two groups; one, referable to the geniculate ganglion of the VII; the other, to the jugular ganglion of the X. The zoster zone for the geniculate is represented on the concha and external meatus, tragus, antitragus, ant-helix, fossa of the ant-helix, and the lobule. That for the ganglion jugulare vagi, on the posterior wall of the auditory canal, posterior half of the tympanic membrane, and a strip of the posteromesial surface of the auricle and adjacent mastoid region. He also expresses the opinion

that the auditory ganglia, the ganglion spirale, and ganglion of Scarpa may be primarily involved in zona. These ganglia take their origin as outgrowths of the neural ridge, from which the cranial ganglia of the spinal type arise, and, like these ganglia, may be brought within the realm of herpes zoster—a disease characterized by an inflammation of ganglia of the so-called spinal type—so that in an acute unilateral disease of the auditory nerve, accompanied by symptoms of a mild general infection, especially after an exposure to cold, the possibility of a primary and isolated herpetic inflammation of the acoustic ganglia must be considered.

The presence of lymphocytosis of the cerebrospinal fluid, which is known to occur in herpes zoster, would be important evidence of the existence of such a condition, and would serve to differentiate it from the so-called “rheumatic palsies” of the auditory nerve.

In conclusion, Dr. Hunt emphasized the importance of testing the hearing in all cases of zona of the cephalic extremity, in order to detect mild degrees of impairment, which would probably escape notice unless especially investigated.

#### TYPES OF THE SYNDROME.

I. Herpes zoster facialis; oticus; or occipito collaris, with facial palsy.

II. Herpes zoster facialis, oticus, and occipito collaris, with acoustic symptoms (deafness, and symptoms of Meniere's disease).

III. Herpes zoster facialis, oticus, and occipito collaris, with facial and auditory symptoms combined.

IV. Herpetic inflammation of the acoustic ganglia with auditory symptoms alone.

DR. LEDERMAN asked Dr. Hunt whether there is any connection between these cases of herpes zoster and infection involving the cerebral cavity in cases of sinus thrombosis or meningitis where herpes of the auricle is noted. Dr. Gruening has reported several cases where he noticed herpes in this region associated with this serious form of infection.

DR. HUNT replied that a localization of herpes on the nose and lip is not uncommon in meningitis, belonging probably to the so-called “infectious group” of herpes, but it is also very probable that an extension of the inflammatory process from



the ear along the nerve sheaths may involve the geniculate ganglion, thus giving rise secondarily to herpes zoster of geniculate origin, and this would be important evidence of the extension of the inflammatory process toward the cranial cavity. He has observed one case of endothelioma springing from the middle ear, in which herpetic pain and vesicles occurred in the geniculate area, and which he regarded as indicating a secondary involvement of the ganglion from without, such as occurs in the spinal ganglia in cases of malignant disease of the vertebrae.

#### **Clinical Symptoms of Labyrinthitis.\***

By PHILIP KERRISON, M. D.,

NEW YORK.

#### **DISCUSSION.**

DR. GEORGE E. DAVIS said that it was a most interesting paper, and doubly so since he also was a student and assistant to Dr. Alexander, who, in conjunction with Dr. Barany, had done much to elaborate and make practical the functional tests in the diagnosis of labyrinthitis. He wished to say in regard to Dr. Kerrison's statement as to his disbelief in the correctness of Dr. Alexander's and Dr. MacKenzie's observations as to the frequency of the reactions (nystagmus) of the galvanic tests, in their experiments on the deaf and dumb, when other tests proved negative—particularly the caloric test—he would offer the explanation that as the contact surface for the caloric test is so limited for the application of heat and cold, that it is just possible one might not get a reaction, whereas you would obtain it from the galvanic test. A point in evidence is the fact that for a short time even after an operation on the labyrinth the galvanic reaction may be elicited.

Responding to Dr. Graef's remark, "that he did not believe the ear had anything to do with the reaction (nystagmus) after turning, and that same was due to the attempt on the part of the patient to fix objects with his eyes while being turned and to recover when the turning ceased," Dr. Davis

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\* See page 493, September, 1909, *Annals*.



said that to demonstrate the error of Dr. Graefe's contention it was only necessary to mention that the "turning" test is made with the eyes closed, or with opaque glasses, to prevent "fixation," and, indeed, the reaction (nystagmus) is even greater when fixation is obviated. Moreover we get nystagmus with the caloric and galvanic tests when the patients sit perfectly quiet.

DR. LEDERMAN inquired whether or not, in testing with the caloric test, where the test is negative, it would not be possible to have some form of cerebral growth which would cause symptoms of nystagmus, vertigo and nausea. Some years ago he had presented a case before the Section showing the symptoms which may arise from pressure on the semicircular canal. The patient was a colored woman, who had been shot with a bullet, which had lodged in the external wall of the internal ear, resting on the facial aqueduct and horizontal canal, with symptoms of facial paralysis, vertigo, nausea, etc. This condition had existed for three years when he first saw her. She had then a chronic suppurative otitis with a fibromyxoma filling the canal, with pus in the canal and middle ear. She was 24 years of age, and was unable to go around without assistance, on account of falling to the affected side. It was impossible to examine the middle ear at first on account of the growth. That was removed by means of a snare, and after removing it and cleansing the canal, the foreign body was seen in the ear, surrounded by osseous deposit. It was impossible to remove the bullet through the canal, and a radical operation was done, but the bullet was wedged in so tightly that it had to be chiselled away. Seventy grains of lead were obtained after the operation. The symptoms of vertigo and nausea disappeared in about four weeks, and the woman had fair hearing. This case was of interest in connection with Dr. Kerrison's statement that sometimes these cases may present evidence of disturbed equilibrium after the symptoms have disappeared. In my case such disturbance remained for three years after the traumatic lesion.

DR. GRAEF said that it was customary when new ideas developed to claim everything in sight to prove them. One point dwelt upon to-night, he thought, had no necessary connection with the labyrinth. He understood that Dr. Kerrison had meant to use it as an analogy to prove his case. If you

set a patient in a revolving chair and whirl him around, he will have nystagmus toward the opposite side when stopped. He understood Dr. Kerrison to say that this was an indication of disturbance in the labyrinth; this, he felt, could not be said with certainty. When turning the head around, the eyes are constantly seeking the point toward which they are turning—then, when the motion is stopped, they immediately try to right themselves and a wavering motion results for a brief time. The exact opposite will occur when the patient is turned to the left. If nystagmus is so important a symptom, we ought to make sure of its limitations. A familiar example of nystagmus of a somewhat similar type is the classical form known as "miner's nystagmus." These men develop such a condition in the eyes from the position assumed by them at work, and here, again, the labyrinth plays no part.

DR. DAVIS said if you use the caloric test you do not get that.

DR. GRAEF pointed out that he referred only to the turning test and had no reference to the effects produced by application of heat or cold to the ear.

DR. COHEN said that he wished to corroborate Dr. Kerrison's test. He had seen two cases of labyrinth disease which responded favorably to Barany's tests, especially the caloric test.

DR. DUEL asked if there was complete absence of the nystagmus in the two cases operated upon, and Dr. Cohen replied in the affirmative. Dr. Alexander also uses an instrument which Dr. Kerrison had not shown, namely, a single silk-covered rubber tube (12 feet long), of which one end is placed in the patient's ear, the other end used by the physician for whisper or conversation voice; this method tests complete deafness of each ear.

DR. KERRISON, in closing the discussion, referred to the statement of Dr. Davis that the galvanic test was useful in some cases in which the caloric test was not. Dr. Kerrison thought that the galvanic test might have corroborative value; but that so many contradictory reactions had been reported that it could not, taken alone, be relied upon as a test of vestibular irritability.

Replying to Dr. Lederman's question as to the value of the caloric test in cases of spontaneous nystagmus depending upon

brain tumors, etc., Dr. Kerrison said the caloric test would hardly be employed in such a case, its chief value being in cases in which spontaneous nystagmus was absent.

Dr. Graef had said that the nystagmus resulting from the turning or rotation experiment was a phenomenon having nothing to do with the labyrinth. This view was obviously and demonstrably erroneous. It has long been known that endolymph movements in the different canals gives rise to nystagmus, which differs in character according to the canals involved and the direction of the endolymph displacement. The rotation of a person, seated with head erect, about a vertical axis, gives rise to displacement of the endolymph in the two horizontal canals, and produces a nystagmus characteristic of this displacement.

## NEW YORK ACADEMY OF MEDICINE.

### SECTION ON OTOTOLOGY.

*Regular Meeting, May 14th, 1909.*

#### **Presentation of a Patient, the Subject of a Brain Abscess With Unusual Features.**

DR. T. PASSMORE BERENS reported the following case: E. G., male, 32 years old, came under my care April 14th. His family history was good. Two years ago he fell, striking his chin, and became unconscious for a short time, but presented no other symptoms for at least a month, when he was seized with an epileptiform convulsion and has had infrequent seizures at irregular intervals since that time. Between four and five months ago had severe pain in the left ear, followed by discharge, which has persisted. Three weeks ago pain again developed in the left ear, and was accompanied by severe headache, localized to the left side, and a slight swelling which extended from above the left auricle well over the temporal region.

On April 3d, a simple mastoidectomy was performed by Dr. C. E. Perkins, of my staff. At the operation, the lateral sinus was found displaced forward, the bone covering it was diseased, and its removal disclosed a perisinus abscess. The limits of the abscess were reached. The wound was packed with iodoform gauze, and the patient returned to bed.

The operation was followed by great relief to the headache, and the patient did well for a few days, when the headache returned, and the swelling in the temporal region became prominent. Examination now revealed an inequality of the pupils, the right being slightly dilated. Both pupils accommodated to light and distance, and the inequality was explained by the patient's statement that they always had been unequal. The whole temporal region, from the orbit to above the auricle, was swollen and pitted deeply on pressure. There was a



profuse discharge of pus from the external auditory canal, and, following the removal of the mastoid packing, there was a profuse discharge of pus from the aditus. A diagnosis of subperiosteal abscess in the temporal fossa was made, and on April 15th the following operation was performed under ether anesthesia:

The original incision was extended by carrying it upward and forward two inches. This disclosed a large subperiosteal abscess occupying the temporal fossa. Near the anterior border of the squama was a small perforation through the bone, surrounded by an area of necrosis an inch in diameter. Through this perforation pus exuded in a steady flow, as blood does from the wound in a large vein. Its quantity was estimated to be four ounces. After the pus ceased flowing, a probe entered for an inch and a half directly inward. The necrosed bone surrounding the perforation was removed by rongeur, leaving an irregularly round opening an inch and one-quarter in diameter. The dura was not adherent to the necrosed bone, but was adherent to the surrounding healthy bone. The dura uncovered was covered with granulation tissue, and at about the center of this area was a perforation allowing the entrance of a probe to the depth of an inch and a half. At this stage the exposed dura and surrounding soft parts were thoroughly cleansed and then protected with gauze soaked in alcohol. The mastoid bone wound was then enlarged, and a radical mastoid operation performed, which was prolonged on account of the extreme hardness of the bone, necessitating the use of the chisel and mallet. The roof of the antrum was intact. The roof of the tympanum had been destroyed by necrosis. The dura was adherent to the bony edges. The epitympanum was filled with granulation tissue, springing from the exposed dura, in the midst of which was a perforation leading directly into the brain, through which a half ounce of pus mixed with shreds of brain tissue exuded. A probe bent to the shape of a semicircle passed into this perforation emerged through the opening in the squamosa. Owing to the delay experienced in removing the posterior wall of the canal, when this probe was passed no pus escaped, intracranial pressure doubtless having discharged it all. A cigarette drain was passed through the perforation in the roof of the attic and brought out through the perforation in the squamosa.

The whole wound was then dressed with iodoform gauze, and the patient placed in bed in good condition.

The convalescence was rapid. The first few days there was a copious discharge of pus, with a few shreds of white brain matter, from both ends of the drain. This rapidly diminished and at the end of the first week had entirely ceased. The third day following operation, drainage was preserved by the insertion of separate cigarette drains, one through the squamosa, the other through the tegmen. These were shortened daily and entirely removed at the end of eight days. The patient sat up in ten days from the date of operation, and is now walking about the ward, fifteen days after the operation. The wound in the brain is closed and the external wound is doing well.

The following points of interest are instructive: The total absence of symptoms pointing to involvement of the central nervous system in such a large abscess in the temporosphenoidal lobe; the large subperiosteal abscess in the temporal fossa in direct communication with the abscess in the brain; the slight febrile reaction in the presence of such a vast amount of pus of streptococcic origin, for the streptococcus was the microorganism responsible, an almost pure culture being obtained; the rapid convalescence.

The direct communication of the granulation tissue in the attic with the brain forcibly emphasizes the need for extreme caution in the mechanical removal of granulations from the middle ear by way of the external auditory canal.

#### DISCUSSION.

DR. JOHNSON stated that the Doctor had been very successful in relieving the patient, and the progress had certainly been as rapid as could be expected. He would like to know, however, why there was an interval between the time of the original operation and the operation for the squamous necrosis. As he understood it, there was a considerable time between the operations. Another point was that there was no statement as to the condition of the sinus—no evidence of whether it retained its normal position throughout and was surrounded by the abscess, or whether it was destroyed during the progress of the disease. These cases are exceedingly interesting, and it would seem that the reason why we are getting a reasonable number of recoveries in such cases

is that the operators are proceeding with a little more freedom than they used to do and are making more complete operations. When there is a condition present that has resulted in necrosis of the various tissues, from the dura out, and possibly from the brain out, certainly the diseased tissue must be thoroughly removed—that is, up to the line of demarcation—if we expect the patient to make a recovery. In this case there seems to have been no operation on the jugular; he would like to know whether the sinus remained healthy.

DR. McCULLAGH replied that the sinus remained healthy up to the time of the operation. There was a perisinus abscess. The brain abscess was in the temporosphenoidal lobe, superior to the sinus. The second operation was performed eleven days after the first. On April 3rd a simple mastoidectomy was performed and the wound packed, and this operation was followed by great relief for a few days. Then the headache returned, the swelling in the temporal region became prominent, and the other operation immediately followed this return of symptoms.

DR. RAE said that to him the most interesting point in the case was the occurrence of two cortical perforations—one through the squama and the other through the roof of the tympanum. He thought that much of the success of the case was due to the through-and-through drainage that was obtained. The Doctor certainly was to be congratulated on the successful outcome of the case.

#### **Presentation of Three Cases Showing Functional and Cosmetic Results After Various Mastoid Operations.**

DR. W. SOHIER BRYANT said of the cases presented, the first one was that of a baby 4 months old, operated upon three months ago. The child was suffering from acute middle-ear suppuration, mastoiditis and subperiosteal abscess. A simple mastoid operation and blood-clot dressing was done, with an ideal result. There was complete reorganization of the whole blood clot, resulting in immediate primary healing of the wound and drum membrane. There was no further suppuration. A barely detectable scar remained. The infection in this case was streptococcus.

In reply to an inquiry from Dr. Johnson as to the area of the bone removed, Dr. Bryant said that it was as large as a twenty-five-cent piece.



The second case was that of a girl, 22 years old, with an acute middle ear suppuration and mastoiditis. The operation was performed two months ago, and revealed a perisinus abscess and a large area of pachymeningitis. There was a great deal of osteomyelitis all the way through. The dura was exposed from the knee above to the horizontal portion below. A small area of the middle fossa and a large area of cerebellar fossa was exposed. The infection in this case was streptococcus. The blood-clot operation was performed in this case also, but the clot melted out. There was practically no suppuration following the operation. As far as the blood clot was concerned, the result was not an ideal one. However, the convalescence was more rapid (16 days) than if the wound had been packed, and the patient's hearing is excellent. The T-scar is barely detectable and the surface is even.

DR. McCULLAGH said that in his cases of blood-clot operation the healing usually was complete in three weeks. In most of them there is more or less concavity, though in some few there is none at all.

DR. BRYANT said that when the blood clot fills the wound cavity thoroughly and organizes there is no concavity—not evening flattening. He always makes deep periosteal sutures, as well as skin sutures, in closing the wound. Otherwise the margin separates and convalescence is delayed.

The third case was that of a lad of 18 years, upon whom a radical operation was performed ten months ago. The best indications for a radical operation were present. The patient had a chronic suppuration with fetid discharge for the last six years. At the time of the operation there was an acute exacerbation with bone involvement. The result is ideal. By looking inside the ear the stapes can be seen in its normal position. The cavity was not packed, and the wound healed quickly. The hearing has remained at its present degree for six months. The patient hears a 36-inch watch at 14 inches. The postaural scar is linear and there is no deformity. Dr. Bryant said that he had never seen a case where there was good hearing after a radical operation in which the tube was closed.

DR. BROWN inquired what percentage of cases of blood-clot operation got perfectly well without any complication.



DR. BRYANT inquired just what Dr. Brown meant by complication, and Dr. Brown explained his query as referring to suppuration in any form; whereupon Dr. Bryant said that he could not answer definitely, but, speaking off-hand, certainly 50 per cent of the cases had no postoperative suppuration. The suppuration which comes on immediately after operation undoubtedly is due to faulty technic, and can be attributed to defective cleansing of the skin, or to some neglect in the dressings, in the sterilization of the instruments, hands, etc.

DR. JOHNSON asked how much time was gained in the shortening of the period required for the repair of the wound in this fifty per cent of the cases in which the clot organized, as against the packing method.

DR. BRYANT replied that it was difficult to state the comparative gain, but that, under any circumstances, with the blood-clot method, convalescence is more rapid than if the wound were packed. In the case of the baby (Case 1), the wound healed immediately. It was solid in a week. If the convalescence is complicated with suppuration, the duration of the convalescence depends upon the extension of the suppuration. When the suppuration occurs, it is usually focused in the lower angle of the wound. Such cases require about three weeks to heal. Dr. Bryant said that he has had cases where there was complete sloughing of the whole wound surface. He did not pack the wound, and the cases recovered in a comparative short time, with a very slight scar. In such cases the drainage was perfect, there being nothing to keep the pus in.

DR. BROWN said that the cases which had been presented to-night show most beautiful results, and one wishes that such might always be expected. He would like to know if these cases are a fair illustration of the results commonly obtained in New York by this method. A series of 60 cases was reported recently, of which 48 had complications of one kind or another, and of the entire 60 only 4 healed without complication.

DR. BRYANT replied that he did not know much about the results obtained in New York or Boston. He did not think that the method was very much used. Dr. Taylor, the house surgeon of the New York Eye and Ear Infirmary, has employed this blood-clot method in several operations, and his

results were about the same as those obtained by Dr. Bryant. The cases shown represent fair examples of the work he has done and of the results which can be obtained in cases without postoperative suppuration. A suppurative case will give the same final appearance as these cases, except that there will be a little more pitting at the lower part of the wound, and the convalescence will be of longer duration, though usually not much longer.

There should be no middle ear suppuration after the operation. If, however, this occurs, it can be checked with a little care.

DR. McCULLAGH said that a point that is not emphasized in blood-clot cases, and one that should be emphasized, is that the longer a mastoid infection has existed before operation the better the chances for a successful blood-clot operation. Sprague claims that they should never be attempted unless the mastoid involvement has persisted for at least ten days, and he considers that three weeks or over is the ideal time. Dr. McCullagh said that he could not at the moment state just how many he had done, but was confident that he had over 50 per cent of successful cures without any suppuration (not absolute successes, but the posterior wound healed up and the middle ear was dry inside of three weeks). The last two cases that he had operated upon by this method were both failures, but they were both very rapid and acute cases. In one of them the patient developed a jugular thrombosis, and the jugular vein had to be resected. In the other one, which was operated upon about ten days ago, the house surgeon poured adrenalin into the wound, before Dr. McCullagh noticed what he was doing, in order to check the bleeding, and undoubtedly that had a very bad effect, for the next day, when the dressing was removed, a purulent discharge was discovered in the wound. The wound was opened up at once with a probe, and there has been no further unpleasantness in the matter. Dr. Reik, in his paper on the subject, claims that the bactericidal effect of the blood—which is more powerful in drawn blood than in blood that is circulating—is due to nuclein, and this nuclein is precipitated by alcohol, and there is little doubt that adrenalin would cause changes in the blood that might have some effect in destroying the bactericidal action of the blood in the wound. If the cases are properly selected, with a view to the

length of the duration of the inflammation, and the opsonic index or resisting power of the organism, there would be much better chances of success in these operations.

DR. BRYANT said that there was no doubt that a very acute infection does not give such good results after operation as one of longer standing. In a circumscribed infection, all the infected area can be removed; whereas an infection which has no discernible boundaries cannot be stopped as effectively.

**Case of Double Mastoiditis Showing Symptoms of Intracranial Involvement. Recovery Without Opening of Cranial Cavity.**

DR. LINN EMERSON reported the following case: M. B., female, age 13. First came November 23, 1908, with a history of double otitis of one week's duration. Both ears discharging. Well-marked mastoiditis, with swelling on the left side. Free double paracentesis performed, and the patient advised to enter hospital at once. Admitted to the Orange Memorial Hospital at 4:15 p. m. on the following day.

Mastoid operation performed on left side on November 25, 1908, at 3:45 p. m. Bone very hard, and but little pus or granulation found. At 8 p. m., respiration 24, pulse 120, temperature  $105.4^{\circ}$  F. Four baths were given, but temperature remained around  $102^{\circ}$  to  $103^{\circ}$  ( $10:30$ ) until 12 noon, the day following operation, when it was  $101.6^{\circ}$ , after bath. Temperature did not go below  $100^{\circ}$  until 7:30 a. m. on the 28th, the third days after operation. At 4 p. m. of the same day it was  $103^{\circ}$ , and the patient had a severe chill and complained of sharp pain in the chest. Careful examination of the chest by several of the attending staff failed to reveal any physical signs of lung involvement. On the fifth day after the operation the afternoon temperature was  $103^{\circ}$ , and on the sixth day it was up to  $106^{\circ}$ , with respiration 26 and pulse 130.

Blood examination gave no Widal, no malarial organisms, and leucocytosis of 50,000.

On the seventh day the patient had a severe chill and a maximum temperature of  $106.2^{\circ}$ . During all this time the mastoid wound was frequently inspected and seemed healthy. The patient ate well, moved about, and sat up in bed; and asked each day when she might go home. At this time a



slight optic neuritis was detected in the right eye (the side opposite to the mastoid operated upon). The right ear had but a small amount of discharge, and there were no evidences of mastoiditis. After consultation with two general surgeons it was decided to open the right mastoid, in view of the oncoming right optic neuritis.

On Wednesday, December 2nd, one week from the date of the first operation, the right mastoid was opened. When the patient left the ward for the operating room, at 1 p. m., the temperature was  $104.6^{\circ}$ , pulse 128, and respiration 28. The right optic neuritis was more advanced, and beginning haziness of the margin of the left disk was now observed. The right mastoid was found sclerosed and no pus or granulations were found. The antrum was not found, and the operation was rather abruptly terminated on account of the poor condition of the patient. The patient reacted well, and the following day the highest temperature was  $101^{\circ}$ , and leucocytosis fell to 14,200. Meanwhile the double optic neuritis continued to advance, but slowly, and after two or three days it remained stationary.

The temperature stayed below  $100^{\circ}$  until the fifth day after the second operation, when the patient had another chill, and the temperature was  $106.4^{\circ}$ ; leucocytosis 30,000.

The conditions were most puzzling. Both wounds looked well. The optic neuritis was slight and stationary. The patient was eating well and asking to go home, and when asked how she felt, replied "first rate." The two days following the chill the temperature was between  $100^{\circ}$  and  $101^{\circ}$  every time it was taken.

Careful watch was maintained and every precaution was made to enter the cranial cavity if more urgent symptoms supervened. The temperature, however, gradually fell to normal, and the patient left the hospital three weeks after the second operation.

A marked facial palsy, which followed the second operation, was entirely well three months later.

It is difficult to explain the high temperature, chills, leucocytosis and optic neuritis in this case, unless it was a mild case of infection of the walls of the sinus without formation of a thrombus.



## DISCUSSION.

DR. EMERSON said that he would like to know if any of the men could hazard a guess as to the character of this case. There was no evidence at any time of lung involvement, cough, or anything of the kind, and he had been much puzzled by the case.

In reply to a query by Dr. McCullagh as to whether the nose had been examined as to the possibility of any trouble in the sphenoidal sinus, Dr. Emerson replied that the nose was examined only in a general way, and that no attempt had been made to probe, or to inspect the nasopharynx. It appeared perfectly healthy when she first came in.

DR. EMERSON said that four or five years before he had reported a case of an adult woman with much more typical symptoms of brain abscess, with double optic neuritis. Operation—a puncture of the temporosphenoidal lobe—failed to reveal any pus. The dura was bulging, and there was considerable serous meningitis. The patient made a rapid recovery after the operation on the skull.

DR. JOHNSON said that he felt quite certain that in this case it would have been desirable to have the spinal fluid carefully examined. He felt positive that the pressure that can be exerted by the spinal fluid, even when there is no bacterial element present, and where there appears to be nothing but an increase in the spinal fluid itself, would account for a very considerable number of serious brain symptoms. The fact that there was an escape in the case of the Doctor's of a very considerable amount of the cerebrospinal fluid, with relief of the symptoms, would be an indication that intracranial pressure was the cause of the cerebrospinal condition. In the case of a person who had received a tremendous blow on the back of the head, with fracture of the occipital bone, there was a tremendous flow of cerebrospinal fluid, which subsequently gradually subsided. During the period of subsidence—there were a number of times in which the flow stopped and then began again—there were marked cerebral symptoms—during each subsidence bearing out the statement he had just made.

**Sequestrum Removed From the Ear of a Child.**

DR. RAE presented this case. The child had had a profuse discharge and a facial paralysis for over a year. The seques-

trum included the inner end of the superior canal wall and the overhanging squama. In the angle between them, that is, on the "floor of the attic," the incus was lying free from all attachments. No trace of the malleus was discovered.

#### Report of Three Interesting Ear Cases.

DR. J. J. THOMPSON: Case 1. Baby, age 8 months. Since birth the baby had been very delicate, very much emaciated, and the cervical glands on both sides were enlarged. At the age of 2 months both ears began to discharge, accompanied by a right-sided facial paralysis. This lasted about two months, when the discharge ceased and the paralysis cleared up. One month before coming under observation the discharge recommenced on the right side and the paralysis returned. This was complete. There was no temperature, no mastoid tenderness, swelling, or redness. The middle ear was completely filled with granulations, and the discharge had a very foul odor. There was no nystagmus, and as far as could be learned there had been no vomiting or tendency to vertigo.

*Operation.*—October 20, 1908, the radical operation was done. There was a perforation of the cortex over the antrum, the malleus and incus were not seen, and the stapes was loose in the granulations that filled the middle ear, and granulations protruded from the oval window. The external semicircular canal was open over the apex of its greatest curvature. The posterior and superior canals were now opened and the vestibule entered through the solid angle. The canal for the facial nerve was not opened, nor was the cochlea. The necrosis had exposed the carotid artery in front.

The tissue removed from the mastoid contained tubercles and giant cells. Following the operation the temperature remained around 102°, the pulse 124, there was no nystagmus present and no tendency to hold the head in any particular position. November 17 the posterior wound was closed and a plastic operation made on the canal. December 20 the patient was discharged from the hospital with the radical cavity dry, the facial paralysis still complete, and the general condition much improved. May 1, 1909, conditions were the same as on the date of discharge from the hospital.

CASE 2.—Albert S., age 8 years, came to Dr. Phillip's clinic at the Manhattan Eye and Ear Hospital January 9, 1909, with

complete facial paralysis on the left side and a subperiosteal abscess over the left mastoid. He walked well, had no nystagmus, and no history of vomiting or vertigo could be obtained. No satisfactory tests of his hearing or tuning-fork tests could be obtained, and the caloric test or test for fistula were not made. The left ear had been discharging for six months and the facial paralysis had existed a month. The middle ear was filled with granulations.

*Operation.*—There was an extensive subperiosteal abscess, containing a large sequestrum, which included the greater part of the mastoid process, the tip and posterior canal wall as deep as the styloid process. The anterior canal wall was absent, and a cavity filled with cheesy material extended inward and forward for about one inch. When this had been cleaned out we discovered that the entire bony eustachian tube had been destroyed. The external and posterior semicircular canals were open and the entire external vestibular wall was missing, as well as the promontory, laying open the first cochlear whorl and exposing the second whorl. The cochlea was filled with discolored exudate. When this was removed cerebrospinal fluid escaped freely through the cochlea and also through the vestibule.

The patient was kept in bed a week. He had no elevation of temperature, nystagmus, or other unpleasant complication. When I placed him on the floor for the first time and asked him to walk, he went in a circle toward the left for about 30 seconds, then straightened out, and has had no sign of vertigo or difficulty in walking since. The cavity filled in well for a time, but laterally the granulations showed a tendency to break down periodically, the discharge continued from the membranous eustachian tube, and the child has since developed a general tuberculosis, with afternoon temperature, and cough, loss of weight and general weakness, so no effort has been made to close the posterior wound. In doing the dressings a fairly good-sized piece of cotton or an applicator could be passed through the eustachian tube into the pharynx.

CASE 3.—This case, while not showing any involvement of the labyrinth, presented some interesting features, and I have taken the liberty of reporting it at this time. Louis S., age 8 years, was seen for the first time April 26, 1908.

In February, 1908, he had had a mastoid operation on the



right side, which had never healed. The wound presented the ordinary appearance of a fistula leading to the antrum, and the boy seemed to be in good health. There was no discharge from the tympanum.

On May 5, a little over a week after I first saw him, he had a chill and his temperature went to  $104\frac{1}{2}$ . The next morning it was  $100\frac{3}{5}$ , pulse 100, respiration 24. He did not complain of anything, the eye grounds were clear and the wound or tympanum had not changed in appearance. That evening the temperature reached  $105\frac{1}{2}$ , and he began to show signs of septic absorption, flushed cheeks, etc.

I decided before doing anything to wait a few days to eliminate erysipelas and exclude general conditions.

Until May 9, four days later, he ran a typical septic temperature, and did not complain of pain or any discomfort. On that day conditions were as follows: The appearance of the wound and tympanum unchanged; the chest and abdomen were normal, with the exception of a splenic enlargement; there was no headache, and he had a long chill every other day. The urine was normal, with the exception of a large amount of indican. The blood examination showed 4,200,000 red cells, 19,000 leucocytes, and hemoglobin 74%. The differential count showed 80% polymorphonuclears, 16% lymphocytes, and 7% mononuclear leucocytes. No plasmodium were present, and the Widal test was negative. A blood culture taken on this day proved to be negative. The examination of the feces did not show anything abnormal.

The chills and septic temperature continued until May 11, six days after their onset, when permission was obtained to explore the lateral sinus.

No clot was found, and very free bleeding occurred from both the torcular and cardiac ends of the sigmoid sinus. The jugular was not disturbed, and no exploration of the cerebrum or cerebellum was attempted at this time.

Next day the temperature was  $105^{\circ}$  and the pulse 118, and the patient had a chill lasting 25 minutes. He now began to complain of severe headache. The reflexes were normal, no Kernig or Babinski sign and the eye grounds were still clear. May 13 he had another chill, lasting 20 minutes, and he had a tendency to sleep a good deal, but was mentally clear when aroused. The cerebrospinal fluid was normal. May 15 he



was still running a septic temperature, ranging from 98 to 105 degrees. Blood examination on this day showed 3,000,000 red cells, 15,500 leucocytes, 65% hemoglobin. Differential count showed 73% polymorphonuclears, 24½% lymphocytes and 2½% mononuclear leucocytes, and a marked poikilocytosis.

Condition continued very much the same until May 24, when, owing to the apparent absorption of pus from some region and the rigid exclusion of other foci, it was decided, even in the absence of any marked intracranial symptoms, to explore the temporosphenoidal lobe and cerebellum. This was done, without finding any pus or other abnormal condition, with the possible exception of an increased flow of cerebrospinal fluid. From that day the boy's recovery was rapid and complete. The next day the highest temperature was 102 4/5, the following day 100 4/5, and from that practically normal. The wound healed without difficulty, and I have seen him frequently since and he continues to enjoy the best of health. The case was of great interest to me, on account of our inability to make a diagnosis and his rapid recovery after opening the dura, without finding anything to account for his symptoms and septic temperature.

# NEW YORK ACADEMY OF MEDICINE.

## SECTION ON OTOTOLOGY.

*Regular Meeting, October 8, 1909.*

DR. ROBERT LEWIS, JR., CHAIRMAN.

### PRESENTATION OF PATIENTS.

#### Commencing Otosclerosis—Second Stage.

DR. WM. SOHIER BRYANT presented an unmarried woman, 33 years old. Has been conscious of impaired hearing in the left ear for two weeks. The impairment in hearing is accompanied by a stuffed-up feeling and buzzing tinnitus. No history of deafness in the family.

*Previous History of Patient.*—Frequent severe "sick headaches." Menstruation always ahead of time.

*Examination.*—An overworked woman, poorly nourished. Both ears have very transparent membrana tympani. No other marked change. Palate narrow and highly arched. Nasal fossæ narrow and poorly developed.

*Functional Tests.*—Watch, A. D., 60/60; A. S., 10/60. Low tone limit, A. D. — 25 S. V. Low tone limit, A. S. — 98 S. V. Upper tone limit, A. D. (1.90 — .81) — 46,500. Upper tone limit, A. S. (2.10 — .81) — 45,000. Fork, 512 S. V. in medium line of head, lateralized to A. S. Fork, 196 S. V. A. S., marked bone conduction, heard for 1 m. 40 sec. Fork, 196, S. V. A. S., air conduction, heard for 1 m. 10 sec. Fork, 196, S. V. A. D., marked bone conduction, heard for 1 m. 17 sec., normal. Fork, 196, S. V. A. D., air conduction, heard for 2 m. 14 sec., normal. Gellé test, positive.

*Prognosis.*—Bad.

DR. BRYANT said that he considered the case one of incipient otosclerosis, not one of long standing or far advanced. The history of the case, as far as the hearing was concerned,

was inconclusive, since the patient did not realize that she had no hearing on the affected side, until she came for treatment for the relief of the tinnitus. No family history was obtainable.

#### DISCUSSION.

DR. DUEL inquired the age and family history of the patient, and Dr. Bryant replied that she was thirty-three years old. There was no history of heredity.

DR. DUEL said that he would doubt the diagnosis of otosclerosis in a case with such uncertain symptoms, particularly without the record of an hereditary defect. A true case of otosclerosis is likely to first manifest symptoms in early adult life; at the age when the development of the bony capsule of the labyrinth should normally cease,—from nineteen to twenty-five years. There is almost always some history of heredity—either one or both parents, or grandparents, an uncle or aunt, brother or sister, has shown a similar defect in early adult life. He would hesitate to make a diagnosis of otosclerosis after only two weeks of such indefinite symptoms in a woman thirty-three years of age.

DR. PHILLIPS agreed with Dr. Duel. He could not think of such a condition under the circumstances described by Dr. Bryant.

#### Symptoms of Internal Ear Suppuration With Report and Presentation of Two Cases. Operation. Recovery.

DR. JOHN MCCOY. The internal ear is invaded by suppuration as a result of acute or chronic suppuration in the middle ear and mastoid. It is frequently, however, a sequel to chronic suppuration. The infection spreads to the internal ear, either by direct extension through the oval or round windows, or along the intercommunicating blood vessels of the middle and internal ear, or by a gradual erosion of the bony capsule of the internal ear at the promontory or semicircular canals. The suppurative involvement of the internal ear may affect the cochlea alone or the vestibular apparatus alone, and the infection in each may be circumscribed or the cochlea and vestibular system may be involved together.

When the end organs of the vestibular branch of the auditory

nerve are invaded by the suppurative process, there occurs at first the symptoms of irritation of this nerve, which are vertigo and nystagmus. The nystagmus\* is directed toward the diseased side. As the inflammatory process progresses the end organs of the vestibular nerve lose their function in a very short time, and the spontaneous nystagmus is then directed to the opposite side. The vertigo and disturbance of equilibrium continue for several days, and the patient, unable to maintain the erect position, lies on the side toward which the nystagmus is directed, as in this way he minimizes the subjective sensations of the nystagmus. These sensations may be described as follows: If there is destruction of the right labyrinth with spontaneous nystagmus to the left, the patient in the erect position complains of vertigo, of apparent turning of objects to the left, and with eyes closed, the sensation of apparently turning of the body to the left. Rhomberg's test, however, shows that the patient really falls to the right. The patient falls opposite to the direction of the nystagmus. When looking in the direction of the nystagmus these subjective sensations become materially increased, and when looking away from the direction of the nystagmus the subjective sensations are materially minimized. Therefore the patient lies in bed on that side toward which the nystagmus is directed, because in looking up from this position he is looking opposite to the direction of the nystagmus and is decidedly more comfortable. After several days the symptoms moderate in severity, the subjective symptoms disappear, and the vertigo is only experienced when the head is turned quickly. After ten to fifteen days, if nature has thrown up a protecting barrier for the brain, the spontaneous nystagmus disappears, and the vestibular apparatus passes into a state of latent destruction. This condition can be detected by the absence of reaction to the caloric and turning tests.

If only a circumscribed portion of the vestibular apparatus is involved, the patient will at first pass through the symptoms of vestibular irritation, and later the caloric and turning tests will show a much diminished excitability of the affected labyrinth and a reaction to the fistula test. These patients are the subjects of attacks of vertigo, which may be of two types. Either the attack comes on without apparent external cause, is severe and prolonged to half an hour or more, with nystagmus during the attack; or, the vertiginous attacks may be mild and last but a few seconds and are apparently brought on by some



external factor, such as bending the head, smoking or drinking.

When suppuration attacks the cochlear branch of the auditory nerve, the symptoms are not so clearly defined. At first there comes the symptom of irritation, tinnitus, and later that of destruction, deafness. But it is not always easy to determine if the tinnitus and deafness are the result of purulent inflammation in the labyrinth or in the middle ear. The hearing tests help but little. However, if the patient, a subject of middle-ear suppuration, says that a great increase in, or complete deafness appeared suddenly, and that this was accompanied by symptoms of vestibular irritation, then if the functional tests show the vestibular apparatus to be normal, we can assume a purulent inflammation of the cochlea. If the cochlear and vestibular branches of the auditory nerve are both involved in the suppurative process, there results a combination of the symptoms just described, as produced by irritation, and destruction of each.

The ultimate diagnosis, however, must be based on the observance of these symptoms, together with the pathologic condition found at operation. In other words, the absence of deafness does not necessarily mean that the cochlea is not involved, as at operation it may be found to have a fistula leading into it, with extensive destruction, and apparently there has been good hearing. Or again, a patient with a slowly eroding cholesteatomatous process may have passed through the stage of irritation and destruction of the vestibular end organs, and the symptoms have been so slight as to have been attributed to some other cause. However, here we can rely on the tests for vestibular function to determine its condition.

In conclusion, the writer would urge in every case of chronic suppuration in the middle ear, and especially before operative procedures are undertaken, that a thorough test of the functioning condition of the cochlear and vestibular branches of the auditory nerve be made.

#### REPORT OF CASES.

CASE 1.—Gaetano M., male, age 25 years, occupation barber, came to the New York Eye and Ear Infirmary on April 2, 1909, and gave the following history: He has had a discharge from the left ear since childhood. On March 23, 1909, he felt as if he had taken cold, and took a Turkish bath. On March 24

rinth. On turning to the right ten times, there was absolutely he had severe headache. March 25, on awakening, he was very dizzy, could not stand up, and vomited. From March 25 to April 2, he felt more or less dizzy all the time. On entrance to the hospital, April 2, examination of the left ear showed the following condition: Membrana tympani destroyed, fundus contained granulations and foul-smelling pus. The tuning-fork was lateralized to the right, the voice was heard three feet from the ear, and the bone conduction was minus. The turning test showed right vestibular apparatus normal, left vestibular apparatus not functioning. The caloric reaction was positive in the right ear, negative in the left ear. Compression and rarefaction of the air in the left ear produced at first nystagmus toward the left side and on rarefaction toward the right. Temperature on admission was 97.4 F.; pulse, 100; respiration, 20. April 2, 1909, the radical mastoid operation was performed, thoroughly exposing the middle ear and mastoid. A fistula was found in the external semicircular canal containing granulations, and a probe passed into the fistulous opening penetrated to the vestibule. The semicircular canals were then removed and the first turn of the cochlea uncapped. The wound was packed in the usual manner and left open to dress from behind. The patient went on to recovery, epidermatization being complete in about twelve weeks.

CASE 2.—Timothy H., age 6 years, was brought to the hospital on July 30, 1909, with the following history: Five days before coming to the hospital he complained of pain in the left ear and dizziness so that he could not stand when he attempted to get up. Both ears have been discharging for the past five years. The dizziness and disturbed equilibrium continued up to the time of entering the hospital. Examination, July 31, 1909. Right ear partially filled with pus, membrana tympani thickened and perforated in inferior part. Left ear contains foul-smelling pus, drum destroyed, granulations in fundus, some tip tenderness. He hears in left ear, a forced whisper at nine inches; Weber test, indefinite. Bone conduction minus. Well-marked spontaneous nystagmus to the right. An attempt at the caloric and fistula tests was made, but the child was so frightened that it was impossible to carry them out. The turning reaction he took very kindly to, and the result showed, after-nystagmus from turning to left, which lasted for 30 seconds, and which indicated a normally functioning right lab-  
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no after-nystagmus, which indicated disease in the left vestibular apparatus.

July 31, 1909, a radical operation was done, thoroughly exposing middle ear and mastoid, a fistulous opening of good size was found, leading into and opening both the horizontal and posterior semicircular canals and extending to the vestibule. The pus in this fistula was extremely foul, and examination of it showed pneumococci and a bacillus resembling bacillus pyocaneus. The semicircular canals were removed, and the first turn of the cochlea uncapped. The wound was packed and left open behind for dressing. Under the usual dressings the boy has progressed to recovery.

#### DISCUSSION.

DR. DENCH said that the account of the two cases of labyrinthine involvement were very interesting, and such work should be reported, for it was a new field. He was much interested in the development of the facial paralysis in these two cases, as one that occurs immediately after the operation and clears up so rapidly is quite rare. The cases he himself had had which developed immediately after operation always did badly. On the other hand, cases which come on twenty-four or forty-eight hours or ten days after the operation, do get well ordinarily without any trouble, so that is not a symptom of any great moment. Such a case can usually have a favorable prognosis. Dr. McCoy was to be congratulated on the results he had obtained. He was glad to hear him speak of the caloric test giving nystagmus in both directions, for there was a good deal still to be learned about this symptom. Barany's rule is almost always right. In a certain number of cases he did get a reaction that was somewhat contradictory, and he had been interested in Dr. McCoy's remarks on that subject.

#### **Paper: Why the Failures After the Radical Mastoid?\***

By JOHN F. BARNHILL, M. D.,

INDIANAPOLIS.

#### DISCUSSION.

DR. GRUENING said that Dr. Barnhill had covered the whole field in his paper and had omitted nothing, and he was very

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\* See page 114.



glad to have heard him. All are guilty of leaving cases to the care of others. He himself had done so this year. On one occasion he had been obliged to go away and leave his cases, and though they were in skilled hands he has felt that perhaps if he had done the work himself the results might have been different. Dr. Barnhill had also mentioned cases where, in spite of everything that had been done, the result was unfavorable. It was sufficient to lower our pride, and when we speak of the radical operation we should always remember that there are many cases that we cannot cure. Dr. Barnhill had not spoken of the hearing, but only of the healing in these cases. We are often asked whether the hearing will be improved, whether it will be stationary, or finally lost. This is also an important matter. The condition may sometimes be improved, there may be no suppuration, and the case may be cured from the surgical standpoint, and yet the patient will be disappointed, for the hearing may not be so good as before. His personal experience is that when the ossicles are removed, and there is a complete healing and epidermatization, as a rule the hearing is not so good after the operation as before. That is the general rule. Some cases are improved, some remain stationary, but the majority of cases do not improve functionally.

With regard to facial paralysis, one thing is to be said. He had seen in young people, for instance, caries around the facial ridge. He has exposed the facial nerve, and seen nervous twitches there; if there is a little caries he leaves it, and does not remove everything. Nature does throw off these if we are careful in the after-treatment. It is sometimes wise to allow a little carious bone to remain around the facial nerve, and not to expose it entirely. He recalled the case of a young girl who, after the radical mastoid operation, had become engaged. Dr. Kopetzky also had seen this case. The facial nerve was exposed, and it was surrounded by a little caries, which he attempted to remove; there was some twitching, and he abstained. If he had caused a facial paralysis in this case he would have wrecked the life of the patient. We cannot always be logical and remove everything. We must consider the human and social sides of such an affair, and sometimes it is better for the patient to have a little discharge remaining, which can be treated later on. It is a great misfortune to produce facial paralysis in a young girl.



DR. DENCH said that the subject was a most interesting one, and he was glad that Dr. Barnhill had started off by saying that faulty after-care was frequently a factor in securing an unfavorable result. There is no more difficult dressing to do than that of a radical mastoid operation, and he was confident that after a man has had a large experience in that line he will shorten the time of complete epidermatization from three to four weeks by being careful. His own experience has been that most men think that after ten or twelve days it is almost impossible to infect the radical cavity. That is not so. It must be treated with respect until the epidermatization is well along. Even after a graft has taken successfully and the cavity is covered with epidermis, infection can take place and granulation tissue will form as if the cavity had not been grafted. In his practice the best results have been obtained in keeping down granulations by wiping out the cavity once a day with an alcohol solution of bichlorid 1/3000. Nothing else keeps it down so well as the alcohol with a little bichlorid in it. In private practice the hygienic surroundings are the best, and he has seen case after case where it was never necessary to use the curette or any chemical agent for removing the granulations. The alcohol and bichlorid will keep granulation tissue down, and it toughens the epithelium, and one avoids entirely the disagreeable feature of exuberant granulations.

With reference to the patency of the eustachian tube, he agreed that it was one of the most common causes of failure to heal, but he had an experience last spring which made him question whether in every instance it was wise to attempt to close the tube. In this case the eustachian tube was practically closed by the graft. Two years after, the patient had a cold, and came into his office with facial paralysis. Secretion had collected under the cicatrized grafted tissue, and as the facial nerve had been exposed at the operation, it became infected. If the eustachian tube had been open, infection under the graft would not have occurred. This was the first time he had even seen any possible danger of closing of the eustachian tube, but sometimes the closing of the tube may not be a good thing.

The size of the meatus does make a great difference as to whether or not these cases get well. He has operated successfully in a number of cases where the only mistake in the pre-

ceding operation was that the meatal opening had not been large enough. You must have a meatal opening proportionate to the size of the cavity to be drained.

The packing of a wound varies in different cases. One can use too much packing, and can pack too long. His own practice is to pack for six or seven days after the pledgets which hold the graft have been removed.

His experience did not coincide with Dr. Gruening's, that the hearing is almost always made worse by the operation. He tells the patient that if the hearing is very good before the operation, it will probably be worse after the operation. He impresses upon the patient's mind that the object of the operation is to stop the discharge, and that a possible impairment of hearing after the operative procedure may be looked for, as a necessary consequence. On the other hand, in cases where the hearing is greatly impaired and functional examination shows that the labyrinth is intact, the radical operation very frequently improves the hearing. Regarding the suggestion of Dr. Gruening, that some diseased bone might be left about the facial nerve, in cases where the nerve was exposed, as the removal of this bone might cause a facial paralysis, Dr. Dench did not agree with the suggestion. He believed that the operation should be thorough in every case, and did not think that as soon as facial twitching was observed, as the result of manipulation in the tympanic cavity, the surgeon should desist from the further removal of bone, provided this bone was diseased. The worst case of facial paralysis that he had ever seen occurred in a young man whose facial nerve was not exposed, as far as could be learned, during the operation. The anesthetist had watched the face carefully, and the face did not twitch once during the operation. When the patient came out of the anesthetic, there was complete facial paralysis.

On the other hand, he has had a number of cases where the face would twitch during the operation, and they have recovered without any facial paralysis, either immediately after the operation or later. If one is very careful and removes the bone in thin layers, it can be removed without much risk to the patient. Another point is to use the curette parallel to the nerve. The bone can be shaved off in very thin layers, and with a reasonable amount of care it is extremely improbable that the nerve will be injured.

DR. JOSEPH C. BECK (Chicago) said that he could only add his experience to that of the gentlemen who had already discussed the paper, of finding practically the same difficulty, with the healing process following the radical operation. With him, the eustachian tube was the structure giving the most trouble in obtaining a perfect result. During the past week he presented before the American Academy of Ophthalmology and Otolaryngology, in New York City, this subject of the management of the eustachian tube following the radical operation. His procedure dealing with the tubes is as follows: After locating with a blunt pointed probe the tympanic end of the tube, a long, slender, sharp curette is passed in as far as the isthmus, the mucous membrane curetted, following which the Dr. Whiting drill is employed, clearing away any possible small cells that may be located within this region. After hemostasis is established, a small skin graft is carried in as far as possible, by means of a special carrier. Against this graft is placed a small piece of gutta percha and on top of that the usual gauze pack.

There were two experiments that he has made in a limited number of cases, following the radical operation, in regard to the eustachian tube, and desired simply to mention here this evening.

First Experiment. Following the above mentioned procedure he obstructed both nares by Bernay's splints, instructing the patient not to attempt to blow the nose nor to swallow unless absolutely necessary for twenty-four hours. Patient was fed by rectal enemata, and the smallest quantities of water given, requiring as little action of the muscles of deglutition as possible. In that way the passage of air and fluid from the pharynx to the ear would be restricted and the graft given a better opportunity to adhere.

Second Experiment. After all ordinary means of closing the tube have failed, he has resorted to the resection of the mucous membrane lining the tube at the pharyngeal end. This is accomplished under local anesthesia, with firm retraction of the soft palate, by the aid of a large laryngeal mirror. The instruments employed are four small knives, which are bent in such a manner as to be easily introduced into the eustachian orifice and beyond it, making an anterior and posterior flap, which are dissected out and crushed together by a strong



artery forceps so that complete cicatrization and obliteration must take place. This experiment was done on two cases with absolute closure of the tube.

As far as the dressing of his cases was concerned, he has discontinued firm packing just as soon as the flaps were sure to be firmly adherent. The gauze strips are always covered by an ointment known as Scharlach-Roth Salbe, 10 per cent. The purpose of this is to increase the time of epidermatization, as has been found in cases in general surgery.

Another point that he wished to make in this connection is his experience with the use of the burr (electric). He has found that the smoother the cavity was made the more rapid was the epidermization, especially if after the employment of the burr, a curette was used to remove small particles of bone dust from the surface.

Secondary skin grafting over such bone surfaces appeared to heal better than when the curettes alone were employed. Another point that Dr. Barnhill has referred to was the extent of the mastoid cells. A radiogram taken before the operation of the healthy as well as the diseased mastoid will be of inestimable value in not overlooking a large group of squamozygomatic cells, as well as in other regions of the mastoid. He has found in a large number of radiographs of the mastoid process a great symmetry of both mastoids, so that one can use the plate of the healthy one as a guide in operation. As to the remarks that had been made in regard to necrotic areas in the vicinity of the facial nerve, he wished to take issue with the gentlemen who would leave a diseased process to spontaneous sequester exfoliation, but he removes all necrotic bone with the greatest of care along the facial canal.

While such procedure may be followed by a facial nerve palsy, he believes that leaving the necrotic process in situ will not only defeat the purpose of the operation, but in time produce a complete facial paralysis, from which a patient will not likely recover.

DR. DUEL said that he had nothing to add to the discussion, but wished to express his gratification over the fact that so many men of large experience were now willing to stand up and narrate many different causes for their own failures in the so-called "radical mastoid operation." To him their frank admissions of occasional failure and discussion of their causes



denoted a great advance in the work. He wished to thank Dr. Barnhill for having presented to the Section so concise and complete a resumé of the subject.

DR. PHILLIPS said that he had had one rather interesting experience in the after-treatment of the radical mastoid operation. The patient was an unusually healthy child of twelve, who had suffered from a continuous aural discharge for six or eight years. He had performed the usual complete radical operation at the Post-Graduate Hospital. The patient was discharged from the hospital in ten days, during which time it so happened that he did not have the opportunity to follow up the after-treatment. Later he learned that there had been a persistent discharge following the operation. Some six or eight weeks following the operation, perhaps as much as ten weeks, he made a very careful examination, and discovered two shreds of gauze in the region of the mastoid antrum. He grasped these with forceps, and pulled out a strip of the original dressing from the posterior part of the wound. To his surprise, he found a dermatization complete throughout the osseous cavity. There was an immediate cessation of the discharge, and upon testing the hearing a few days later the hearing was found to be perfect in the ear which had been operated upon. She could hear the whispered voice at a distance of twenty feet distinctly, and acumeter at thirty feet. There has been no disturbance since. It might be a good thing to leave all wounds packed for a long time, if one could thereby get such results.

He had been much interested in the remarks in regard to the complete and permanent blocking of the eustachian tube. He holds the same views himself, but wondered if any of the speakers had tested the eustachian tube six months or a year after operation to see if it remained closed. He had somewhere read that permanent closure of the eustachian tube rarely occurs—that after a time, even though the discharge stops, the tube is patulous and open. He was inclined to think that might be true after a prolonged period of time—say from six months to a year. It would be interesting to know if the cases referred to to-night could be examined to find out.

The effect upon the hearing is not the primary thought in radical operation. It is performed for the purpose of removing a necrotic process from the temporal bone, a condi-

tion which is attended by considerable danger, and its removal is the proper surgical procedure, even as it is when there is necrosis of the bones in any part of the body. In performing the radical waiting operation, we hope to get the best hearing results, but the operation primarily is for the removal of necrosed bone from a location which is more dangerous than in most parts of the body.

DR. KOPETZKY said that the discussion centered more or less upon the subject of the failures which obtained after the radical mastoid operation had been performed. If the question were discussed from another aspect, namely, judging the failures from the radical in relation to the lesions for which we operated, then there would be a different conclusion, and perhaps a solution of the question presented by Dr. Barnhill. As Dr. Phillips had remarked, in cases with necrosis, given a fair amount of care and skill in operating, and the results are usually good. In another set of cases, however, those in which the pathologic conditions presented are not bone necroses, the results are entirely different. In cases where there is a nasopharyngeal involvement, or the eustachian tube is affected, and the ear evidences a chronic purulent discharge, we have found that, pathologically, the disease is a lesion affecting the mucous membrane of the tubotympanic air spaces, and, so far as his experience went with such cases, they proved invariably the hardest to heal after radical mastoid operation. For, if a shred of the diseased membrane be left in the cavity—and there must perforce be small portions of it left, at the niches of the oval and the round windows, and in the deeper-lying parts of the tympanic orifice of the eustachian tube—then the infection spreads from these shreds and affects the new granulation tissue and the newly formed epidermis, which, becoming diseased, break down and the suppuration continues.

Besides, the disease is really a contiguous involvement, affecting the entire eustachian tube. It is such conditions as this that give the largest proportion of failures after radical mastoid operation. If it were only understood, in cases evidencing such findings as those just described, that the opening and cleansing out of the tympanomastoid cavity was only a step in their treatment, we would not look for a perfectly dry ear as a result of operation in these cases.

Then there are the specific lesions which give poor results

after operation. These cases should be eliminated when discussing our results after the operation.

Separating the specific lesions in the middle ear spaces, and the cases outlined above, the radical operation will be found successful in direct proportion to the thoroughness with which the necrosis is removed, and our failures to procure dry, clean, fully epidermatized ears will be found among the cases where there had been involvements of the mucous membrane of the middle ear spaces.

Finally, regarding technic, it is conceded that the non-closure of the eustachian tube is the cause of most failures in the cases evidencing necrosis. On the other hand, there are a set of cells along the walls of the tympanic tubal orifice which often are the seat of infection, and the suppuration from which, when they are not eviscerated at the time of operation, is construed to be a discharge from an open eustachian tube orifice, and the failure of the operation is attributed to non-closure of the tube. More attention to these cells and to the epitympanum generally obviates this origin of continued suppuration.

DR. GRUENING said that with the four points made by Dr. Whiting and Dr. Dench, it would appear that we are now in position to cure every case of chronic otorrhea. The discussion, however, did not seem to be along the lines of Dr. Barnhill's paper, but seemed to center upon the cases that can be cured. Dr. Barnhill's subject was to know why we fail. The discussion did not enter so much upon that. It was not—Why we do not fail. We all have successes, but to-night we are, and we shall always be, more interested in our failures than our successes.

DR. FELIX COHN said that it had not been originally his intention to participate in the discussion of Dr. Barnhill's exhaustive and clear paper on the "Failures of the Radical Operation," had it not been for the remarks of the previous speaker (Dr. Gruening), who referred to the fact that the discussion had confined itself more to the technic of the radical operation rather than to Dr. Barnhill's paper; that evidently had been the case; it appears rather strange that we should still be discussing the technic of an operation which was, or was supposed to have been, perfected twenty years ago. There must be a cause for this, and the cause must be sought



either in the fact that the radical operation is not yet a perfected operation, or that—and that appears to me the most probable cause—that the Stacke operation has not always been carried out in the manner recommended by him. The radical operation was proposed in the years 1891 and 1892, and is an absolutely typical operation, as far as the osseous part of the operation is concerned. No matter how often the operation is performed, and no matter in what cases, with but rare exceptions the picture presented by the opened-up cavity at its completion is uniformly the same. No matter whether we follow Stacke or Schwartz, whether we attack the mastoid bone from the tympanic cavity, or the antrum, or in any other way—from the apex, or posterior wall—the picture presented at the completion of the operation is always identical—the inverted omega, to which Stacke referred to in his description of the operation. The sides of the omega may vary in size or in their exact relation, but upon completion we must have an absolutely similar picture, whether you operate a dozen or fifty cases. If you are careful in shaving down the spur which separates the sides of the omega, and look out for the bone ledges in the epitympanum, and likewise thoroughly level and expose the hypotympanum, the epidermis, whether grafted or supplied by plastic from the meatus, is in a favorable condition to gradually cover the osseous surface. Unless there are diseased foci or bone on the wall of the cavity, on the labyrinthine wall, or otherwise, over which epidermis cannot grow, a successful outcome must result—provided no mistakes are made in the after-treatment. A great many of the supposed failures are, therefore, really failures due to faulty technic, either in the course of the operation or in the after-treatment. Though the osseous part of the operation is a typical operation, in the after-treatment we cannot schematize, but every case must be treated individually. Tight and sectional packing, which may be excellent in one case, may cause or maintain an osteitis in another, so that frequently ordinary surgical drainage, powder treatment, or application of ointment-gauze, will produce better results than the routine treatment originally recommended. In regard to the manner of introducing epidermis in the cavity, there are various methods. Personally, the speaker has had very good results with the Stacke and Panse flaps, or with slight modifications, depending upon the individual case.



With reference to the failures of a radical operation, that a diseased labyrinthine wall, preventing a cure, cannot be considered as a failure to be attributed to the radical operation, is clear, as the typical operation does not include operations upon the labyrinthine wall, etc.; nor can we speak of failures of the radical operation in operations already complicated by intracranial lesions. Nor can we speak of failures in dealing with chronic morbid conditions of the temporal bone, due to constitutional derangements, tuberculosis, syphilis, etc. Such failures, due to necrosis of contiguous portions of the temporal bone, or to constitutional changes, are not actual failures to be ascribed to the radical operation.

In regard to the failures supposedly due to the eustachian tube, the speaker had formed no positive opinion. It is his experience, however, that in only a few of the cases can the eustachian tube be held responsible for recurring otorrheas.

There are also a number of failures, which are likewise not actual failures, inasmuch as they are dependent upon individual diathesis—the speaker refers to the so-called “epidermis relapses.” If we consider that there are many individuals who normally secrete a great deal of cerumen, and that there are others who secrete very little, if any, we can readily see that the character of the epidermis must vary with the individual. In a great many cases, therefore, we find the epidermis remains absolutely normal, without even any perceptible desquamation, for years. In other cases seborrheic and eczematous conditions of the adherent and always poorly nourished epidermis may cause secondary infections, but these conditions are usually easily coped with and are only transient if treated, and cannot be considered as failures.

Dr. Gruening has frequently in his discussions referred to facial paralysis occurring in the course of the radical operation. As one of the causes, he had made reference to necrotic areas near the facial. While it is possible that on very rare occasions these conditions might cause facial paralysis, such lesions are comparatively rare, and it is more likely that facial paralysis is due to other causes—the most frequent cause, some error in technic. Formerly facial paralyses were much more frequently reported; they occur less frequently now, simply because the individual operators have gradually improved their technic. As a great many otolo-

gists, instead of following the methods laid down by Stacke, evolved their own technic, or followed other methods, it was natural that their results at first were not equal to those obtained by them after a more intimate acquaintance with the technic of the radical operation. Stacke especially recommended the typical operation, and developed the method solely for the purpose of preventing facial paralysis, and it was not uncommon for those visiting the clinic of Schwartz, for example, as far back as 1893, 1894 and 1895, to see twenty and thirty cases of radical operations under treatment without a single facial paralysis. That occasionally a facial paralysis may occur is true; it may occur at any time, and any one; but too many facial paralyses are due to some error in the technic of the individual operator in not adhering closely to the method as originally laid down by Stacke. It is the opinion of the speaker that in the consideration of the radical operation we should omit entirely in our discussions all reference to the occurrence of facial paralysis, and especially in our recommendation of this most important operation to our patients. The occurrence of facial paralysis must simply be considered a rare accident, similar to occasional accidents which occur in operations about other parts of the body.

DR. BARNHILL, in closing the discussion, remarked that there was very little to be added. The paper had been very thoroughly discussed, and with that discussion he agreed in the main. Concerning the eustachian tube, he believed that most men who operate believe this to be the cause of the majority of failures. He was somewhat disappointed in that one assertion he had made in the paper was not at least moderately assailed. Perhaps it was not understood—it was to the effect that if the pharyngeal end of the tube is put in a thoroughly aseptic condition and freed from obstruction, the patency of the tube itself was not so harmful as it is thought to be. Notwithstanding his belief that this assertion is true, he tries to give the same care in assuring closure of the tube that had been asserted to be necessary by those who had spoken in the most radical way. He cannot get away from the belief that there is a relation between the pharyngeal end of the tube and the continued aural discharge after operation. As he had stated in the paper, should we operate on a case of frontal sinus suppuration in which there is a complicating in-

fection of the anterior ethmoid cells, but do not eradicate the disease in these cells and in the infundibulum, failure to cure may be expected. The condition present in chronic suppuration of the temporal bone is somewhat similar, in that the most thorough operation on the mastoid will fail to cure if there are infected structures in the nasopharynx which are not thoroughly dealt with at the same time. At least it was true in his experience that if he did not get rid of any diseased nasopharyngeal condition his efforts to complete the closure of the tube were not always successful. One is apt to overlook the fact, with which all are familiar, namely, that the nasopharynx is undoubtedly a part of the auditory apparatus, at least when it comes to diseases of the ear and to the radical operation on the ear. We should never forget that the original cause of the trouble for which we operate entered the middle ear and mastoid through the eustachian tube, and if we propose to reverse the process without trying to get rid of the cause of the disease we are proceeding in a backward manner.

As to the effect on the hearing, mentioned by Dr. Gruening, in relation to the radical operation, it was the speaker's opinion that this was not an operation intended to improve the hearing. It is intended to eradicate a suppurative condition of the bone and its environment. That condition is a danger to the life of the individual which it is highly desirable he should be rid of. His experience was that the hearing was little, if any, improved; but he usually states to the patient that it is not likely to be more seriously impaired.

Probably all agreed with what Dr. Whiting had said in regard to removing the epitympanic walls. There is no question about the necessity for thoroughness here. He had said in his paper that the epidermal tissue will not climb osseous walls or descend into trenches left in the bone by the operator. The entire tympanic cavity must be put in a smooth condition and left free from all necrosis, and if that is done thoroughly, as he had seen it done here in New York recently; if the operation is followed by proper after-care, and if the patient has no diathesis of any serious kind, one may in all reason expect the case to get well. In most cases there is a warfare between our fear of doing the patient more damage than good, a fear of leveling down the facial ridge to the proper plane, or a fear

of severe hemorrhage from going into the deep cells of the eustachian tube. While there is this warfare between doing too little and doing what we know ought to be done, if we go as far as we should; if efficient care for the wound that is made is given, and if the patient is in good physical condition, the radical operation is no doubt as often successful as is other major surgical procedures.



## NEW YORK OTOLOGICAL SOCIETY.

*Stated Meeting, Held May 25, 1909.*

DR. JOHN L. ADAMS IN THE CHAIR.

### **Specimen Showing Infection Through Internal Auditory Meatus.**

DR. ARTHUR B. DUEL said that he wished to present a specimen removed from a case that he had recently operated on, which presented symptoms of sufficient interest to make it worth while to call to the attention of the Society. The patient was a young nurse in the Manhattan Hospital, and first came to the clinic because of pain in her ear and noises in her head. Upon examination the drum membrane was found to be translucent and somewhat retracted. She had a "tender" mastoid and she complained of some pain in that region. Inasmuch as she was a young and impressionable nurse, and had seen many serious mastoid cases, he had largely disregarded the symptoms of mastoid tenderness. The house surgeon had seen her previously for the same symptoms, and with the same retraction of the drum membrane, and he had inflated the middle ear by catheter. Dr. Duel did the same thing. She had a tubal catarrh, and the pain seemed referable to the retraction of the drum membrane. With the inflation there were no evidences of fluid in the middle ear. She was told to report back to the clinic in two days. In the meantime the ear was inflated by the house surgeon on the following day. The next day they telephoned Dr. Duel that she had marked pain and that the drum membrane was slightly bulging, and advised a myringotomy. He was told that following the incision a viscid fluid escaped. When he saw her that same afternoon the drum membrane was retracted and she still had some pain. There was no fluid escaping from the middle ear. She still had mastoid tenderness and complained of pain over the mastoid. She had no temperature. She remained in bed on a light diet. For the next two days there was no evidence of fluid in the middle ear. Dr. Duel left town that day, but told his assistant to look after her, and assured her that she had no mastoiditis.

However, on the following day a thin, yellowish discharge came from the middle ear, and she developed some temperature. On the following day the symptoms increased to such an extent that operation was advised. Dr. Duel returned on Monday morning, and finding that she had definite symptoms, with temperature, told her that he must retract what he said before going away, and that she should be operated on that same afternoon. She had a very thin cortex and the mastoid was a pneumatic one. The cells were filled with pus, granulations and necrotic tissue; it appeared as if a hemorrhage had occurred in the mastoid and that the clots had partially broken down. On the morning following the operation it was reported to him that she had been vomiting frequently during the night. She was extremely dizzy. Dr. Duel at once saw her and found on examination that she had a violent nystagmus away from the operated side; on looking away from the operated side this was increased; looking up caused a screw-like motion of the eye. She was made dizzy when she moved in bed, particularly when the wounded side was up. These symptoms continued for forty-eight hours. In the meantime Dr. Duel called in consultation several surgeons in the hospital to show the interesting symptoms, and also to get an expression of feeling whether it would be wise to operate upon her for labyrinthitis. Inasmuch as she did not have a very high temperature, and as he had seen many similar cases before they knew so much about nystagmus, dizziness, etc., they decided that they would not operate. Within forty-eight hours the nystagmus and other movements had practically disappeared and she was perfectly rational, with no evidences of mental fogging. She then developed a temperature of 106. That afternoon spinal puncture was made by Dr. Zabriskie, but it was a "dry tap"; only one drop of fluid was obtained from the spinal canal. After consultation with Dr. McKernon and Dr. Kerrison, they decided that the only thing to do was to operate, which he did. He entered the labyrinth posteriorly. Throughout the labyrinth was found pus and granulation tissue, similar to that found in the mastoid. As shown by the chart, the temperature came down gradually for twelve hours following the operation to 103.2. A few hours later she suddenly developed a higher temperature, 106, then 107, and during the last four or five hours before death she was unconscious.

The specimen was a very beautiful one, showing the method of entrance of the infection directly through internal auditory meatus along the course of the seventh and eighth cranial nerves. The color was well preserved and showed the exudate along these nerves and at the base. There was present a diffuse leptomeningitis.

DR. JOSEPH A. KENEFICK asked what was the nature of the infection.

DR. DUEL replied that the first smears taken from the ear showed a mixed variety, but that later smears showed streptococci; the blood cultures showed streptococcemia. The leucocyte count was about 24,000, with a polymorphonuclear percentage of 87 per cent. No tuning-fork test was made.

DR. HARRIS asked if there was at the time of operation any indication of any involvement of the inner wall.

DR. DUEL replied, not at all. The petrous portion laid out in the wound very prominently; the cortex was of ivory-like hardness, and it would have been very easy to see any opening there.

DR. HARRIS asked if any fistula was discoverable at the time of the second operation.

DR. DUEL replied that at the time of the first operation the middle ear had not been invaded. But in the second operation the facial nerve was apparently exposed. Touching the granulations in the middle ear caused repeated muscular twitchings of the face. The facial nerve was exposed posteriorly in the operation; the twitchings were not from touching this point, but apparently from touching the granulations in and about the oval window.

DR. GRUENING asked if the sinus was opened at the autopsy.

DR. DUEL replied that it was, but nothing was found. The sinus wall appeared healthy.

DR. GRUENING said that all cases of meningitis were complicated by bacteremia. He asked Dr. Duel if the infection could be traced from the labyrinth into the brain.

DR. DUEL replied that it could be traced directly along the course of the seventh and eighth cranial nerves. The vestibule and semicircular canals contained a thin grumous mass of granulations and pus.



DR. FREDERICK WHITING presented some

**Instruments for the Removal of the Labyrinth, Semicircular Canal,  
Vestibule and Cochlea.**

He had used them a great deal during the past winter and with satisfaction. They consisted of a form of gouge, forward bent and so arranged that after the mastoid had been removed, one could rapidly remove with them the semicircular canals. Under favorable conditions one could remove the semicircular canals very quickly indeed.

In addition, he showed some chisels which worked very nicely, both for removing the semicircular canals and for opening the vestibule widely, allowing one to get below the facial ridge.

For the removal of the cochlea it seemed to Dr. Whiting that the instruments worked very excellently.

He presented a retractor which, for want of a better name, he called the "claw-hammer retractor," which was for use both as an ordinary retractor in ordinary radical operation and in the labyrinthian operation. The retractor contained an eye in the back through which an ordinary piece of gauze was passed; this wick of gauze was drawn from below up through the meatus in such a way as to invaginate the fibrocartilaginous meatus upon itself. This drew the orifice directly upwards; the circular portion of the fibrocartilaginous meatus was held up out of the way. Care should be used not to allow the loop of fibrocartilaginous meatus to protrude downward into the bony meatus, where it would obscure vision. With that appliance the circular portion of the fibrocartilaginous meatus was invaginated; when drawn upon, it held the meatus out of the way. The claw-hammer portion of the retractor was malleable and held the large anterior flap well out of the way. It allowed one to have an admirable view of the operative field. The retractors were very simple, and in the cases he had used them he had found them very satisfactory.

DR. GRUENING said he had had the privilege of seeing Dr. Whiting work with the instruments presented, and he thought that the claims made for them were good. He never saw such an exposure as he got with the retractor. He found that the gouge worked without difficulty. In a very short time he laid the labyrinth bare, and the chisel used was adapted to the size



of the semicircular canals and of the promontory. He believed these instruments to be useful in advanced work. He asked who made them.

DR. WHITING replied that Mr. Ford made them for him.

DR. DUEL asked if he freed the anterior part of the cartilaginous canal.

DR. WHITING replied that one could use the instruments without freeing it, but it was better to free it in order to get a better exposure. It gave an admirable view of the operative field when it was freed. He had never seen anything occur disadvantageous when it was freed.

DR. DUEL had thought it was best, in the radical operation, not to free the anterior part of the cartilaginous canal, subsequent treatment being easier and healing taking place more rapidly. In labyrinth exenteration one naturally wanted all the space that it was possible to obtain.

#### **Mastoid Operation Followed by Joint Pains.**

DR. STEPHEN HENRY LUTZ presented an interesting case. This patient had been operated upon for mastoiditis two weeks ago yesterday, after having had the trouble for a little over one week. He saw the woman Wednesday, three weeks ago to-morrow, and then advised operation. She had been sick two or three days then. She lived out of the city. Two weeks ago yesterday she was operated on, and she did nicely for four days, when she had a little rise in temperature. The only thing he could note was a badly coated tongue. Her condition became worse. She had swelling under one eye on the same side that she was operated on, but this went down the following day. The urinary examination was negative, except for some epithelial cells, but no casts. Her temperature kept going up. About the fifth, sixth and seventh day after the operation she had extreme pain in the hip on the same side she was operated on; two days later she had pain in the other hip. There was no swelling or redness; just this pain. There was extreme sensitiveness to pressure. A blood culture was made, but showed nothing. One joint after another became involved. She was given aspirin 5 gr. every two hours, and then the temperature came down readily. From this time on, buttermilk was her sole diet for one week and the tongue and intestinal canal cleared up rapidly, and she had no more

trouble, and she was walking outdoors in less than three weeks after operation.

#### **Meningitis.**

DR. JOHN E. SHEPPARD reported the case of a child of seven years who was sent to him at the hospital for operation, with a diagnosis of lateral sinus trouble. The history given was that the patient had had scarlet fever eight or nine weeks previous to the time he first saw her. She had running ears, which ceased in about three weeks. There were no evidences of any complication at that time, so far as could be learned. Her temperature was high during her attack of scarlet fever, but soon went to the normal. She then ran a series of temperatures, running from  $104^{\circ}$  up, lasting three or four days, when it would return to normal again. After about a two weeks' interval with a normal temperature, the temperature again went up rather gradually to  $101^{\circ}$  or  $102^{\circ}$  and lasted for two or three days. At that time a neurologist saw the patient and made up his mind that this was a case of a fresh focus of sepsis, because of the three periods of elevated temperature. Lateral sinus trouble was diagnosticated, and the patient was sent to the hospital.

Dr. Sheppard saw the patient and found the drum membrane normal. Both mastoids were tender, one more so than the other. He did not attach much weight to this symptom, because the child was irritable and very fussy. No blood cultures had been previously taken, and the one asked for then showed nothing. The white blood count showed about 8,000 and a polymorphonuclear percentage of 67. In the spinal fluid were found streptococci. The pupils were moderately dilated and equal in size, but sluggishly responsive to light. The knees were drawn up and firmly flexed. He declined to operate, but kept the patient under close observation. The temperature ran from  $101^{\circ}$  to  $103^{\circ}$ . The patient was taken from the hospital, and Dr. Sheppard understands that she has since died. The neurologist took him severely to task for not operating.

He did not like to operate upon meningitis cases after spinal puncture has resulted in the escape of cloudy fluid. It was interesting to note that this neurologist assured him that there was in this case a hydrocephalus—the head having grown a little more than 1 cm. between his two visits.

**Lateral Sinus and Jugular Thrombosis With Removal of Entire Jugular.**

DR. FRANCIS J. QUINLAN reported the case of a man, forty years old, who was sent to St. Vincent's Hospital seven years ago. He entered with pain over the ear, which radiated to the mastoid. An examination of the drum membrane revealed some slight injection along the hammer; there was no bulging or sagging posteriorly or superiorly. The pain continued with great severity and prevented him from sleeping. Irrigations were given every two hours. At the end of two weeks he was still in the same condition. The blood count showed 8,000 white cells and a 74 per cent polymorphonuclears. The patient had no temperature. The pulse ranged from 80 to 90. The objective symptoms were somewhat negative. From what was presented by the patient, he thought there might be some mischief in the sinus, and the man was prepared for operation.

There was a very hard cortex. When the outer table was removed he found that he had to deal with some pus and a great deal of granulation tissue. After cleaning this out the sinus was investigated; this seemed reddened and had a peculiar yellowish-white, dirty look. Upon further exploration he found a solid mass. He endeavored to establish the circulation, which he found rather difficult, although he succeeded. Below the bulb he found a hard, fibrous mass. The jugular vein was removed in its entirety, and the patient made an uneventful recovery. The incision in the neck, which was necessitated, left a very small scar, and the mastoid opening closed nicely. There was no discharge.

This case presented several peculiar aspects. Except for the intense pain, there was nothing to account for the hidden mischief. There was some edema, but there was no temperature which might show absorption. Nothing was to be found in the blood examination. This was what he termed a hypothetical case, one that ran from the traditional lines in cases of this kind.

DR. EDWARD B. DENCH asked if he understood Dr. Quinlan to say that there was a discharge from the ear.

DR. QUINLAN replied that there had been none at all.

DR. DENCH asked if there had been a previous history of discharge from the ear.



DR. QUINLAN replied, none whatever. There was nothing but this intense pain. It looked at first as if the woman was neurotic, in the absence of other symptoms.

DR. DENCH said that sinus trouble was probably present, but there was no clot.

DR. QUINLAN said that the sinus was obliterated by one large thrombus. There was one solid mass of fibrous structure.

DR. DENCH asked if there was any clot at all.

DR. QUINLAN replied that there was none.

DR. DENCH said that he had met with several similar conditions, with a history of no discharge. He thought that there were a certain number of cases where the obliteration of the lateral sinus was a protective measure on the part of nature.

DR. QUINLAN said that the circulation below was not entirely stopped. Smears made from the granulation tissue showed chains of streptococci.

DR. DENCH asked if the same was shown in smears taken from the mastoid.

DR. QUINLAN replied in the affirmative. The patient denied ever having had any trouble with her ear in her life.

DR. JOHN E. SHEPPARD asked how long had pain existed in that ear.

DR. QUINLAN replied, one week.

DR. JOHN L. ADAMS asked how long the patient had been under observation before the operation was performed.

DR. QUINLAN replied that the patient had been in the hospital two weeks, and she had complained for one week before entering.

DR. ADAMS asked if there had been any temperature before that.

DR. QUINLAN replied that he could not tell. She had an abnormal pulse, never being over 85.

DR. DENCH said that the case seemed interesting to him because it showed the existence of a certain number of cases with suppuration in the mastoid, where the sinus may be shut off by a nonseptic clot, exactly as in epidural abscesses, localized collections of pus, with no involvement of the general meningeal spaces, occur. This case was certainly a unique observation, so far as the temperature was concerned, and he had never seen anything like it. He had a case in mind, a man



whom he had operated upon early, but in this instance there was a history of a discharge from the ear. A similar condition was found in the sinus. He operated on the sinus and also tied the jugular. This man made a perfect recovery. If the sinus was apparently closed in these cases, he said he was inclined to let the jugular alone. If the sinus was obliterated, there was no chance for absorption to take place. If symptoms occurred, they were an indication that absorption was taking place.

DR. STEPHEN H. LUTZ said that he had met with the condition twice. Both gave a history of old running ears. In one case he tied the jugular, and the case recovered. In the second case, one week ago, the patient had a hard white cord in the jugular, with a small perisinus abscess. This old organized clot seemed completely to obstruct the sinus, but the sinus looked healthy above and below the thrombus, so the jugular was not tied in this case, and the patient made a rapid recovery.

DR. WENDELL C. PHILLIPS said he did not grasp Dr. Quinlan's statement regarding the temperature.

DR. QUINLAN said that there was no rise in temperature.

DR. PHILLIPS said that in those cases of the type described by Dr. Quinlan, they should try to eliminate carefully the possibility of some syphilitic trouble in the mastoid region, or some other disease of that type. The history of the case pointed strongly in that direction. He thought there had been a tertiary manifestation of syphilis in the mastoid region. There might have been a broken down gumma.

DR. DUEL asked how streptococci in the granulations and pus could be accounted for.

DR. GRUENING said he had seen such conditions, but not in cases giving the history that Dr. Quinlan gave. All the cases had long-standing ear disease. He had never seen such a sinus. He had cases presenting this hard white cord-like structure; some died and some got well.

DR. PHILLIPS said that one never saw a condition of the kind described by Dr. Quinlan, with the drum membrane not broken.

DR. QUINLAN said that there was a small drop, a tiny bit, of mucoid rather than purulent material in the tip of the mastoid.

DR. SHEPPARD called to mind a case he saw a number of years ago. A man was sent from the jail to the hospital for observation. He had no running ears. He had middle-ear inflammation and mastoid tenderness. The mastoid was opened, and the entire lateral sinus was found obliterated. Nothing further was done to the sinus. An abscess in the cerebellum was found and opened. The patient died, and at autopsy it was shown that another abscess existed, which had not been found, and had caused the man's death. It seemed to him that in cases of that kind it was unnecessary to go down to the jugular unless septic symptoms arose.

DR. DUEL said that an interesting point arose as to how the infection had occurred in the mastoid; either it must be that the infection had taken place through the blood current, without involving the middle ear, or else one must admit a middle-ear inflammation. He did not think it was at all impossible for the infection to travel through the eustachian tube to the middle ear and so involve the mastoid without showing any visible signs of trouble in the middle ear. This was particularly so in those cases where pain in the ear had occurred some days prior to when first seen. There might have been an inflammation present just sufficient to cause congestion of the drum membrane, passing on to the mastoid, without causing an abscess in the tympanum. This, he thought, might be a rational explanation of the source of invasion.

DR. THOMAS J. HARRIS said he had no doubt but that they all would accept the theory Dr. Duel advanced; it was not merely a possibility, but he was sure that infection occurred this way in a certain number of cases. It was pretty well accepted on the other hand that this did take place in a certain percentage of the cases.

DR. DUEL said that in the case of the specimen previously shown, there were no early evidences of middle-ear infection at all. The patient had been under observation for many days. There had been a clear drum membrane with some retraction for a time. Nevertheless, when the mastoid was entered, after four or five days, there were evidences that there had been infection present from the onset.

DR. QUINLAN said that he forgot to add that in the section removed the pathologist found streptococci present.

DR. DENCH asked if the streptococci were found in the walls of the veins.

DR. QUINLAN replied that the pathologist said that the streptococci were found in the specimen; he did not say that they were found in the walls of the veins.

DR. DENCH asked if there was any clot in the vein when taken out.

DR. QUINLAN said that it was like a piece of twisted twine exaggerated. It was a white cord, which became thicker and thicker as one came down. He could not map out the veins or clots; they were so agglutinated that it was impossible to separate one from the other.

DR. DENCH said that germs were frequently found in the walls of veins, although one may find perfectly healthy clot in the veins. Streptococci were frequently found in the walls of veins, probably getting there through the vasa vasorum more readily than through the general circulation.

#### **Wound of Subclavian Vein During Operation.**

DR. WENDELL C. PHILLIPS made a report of an unhappy event which occurred during an operation, a resection of the jugular vein. The case had already been reported at one of the meetings of the L. B. O. Society this winter. Dr. T. was working with him. In their efforts to proceed rapidly both were working in the wound. The subclavian vein was wounded at the point where the jugular vein entered. The hemorrhage, of course, was terrific. He reported this case in order to show how he was able to control the hemorrhage. Immediately strips were passed down into the mediastinum, pressed against the wounded vein, and held there until the proper packing could be attended to. Not being sure of his first packing, he withdrew it, and this was followed by another hemorrhage, but the patient did not lose much blood. He then packed very tightly. After about four days he took out the packing, and there was no recurrence of the bleeding. He gave immediately an intravenous saline injection. The accident did not have a deleterious effect on the outcome of the case. The case was known to be a fatal case, anyway. The patient lived three weeks after the accident.

#### **Pus in Mastoid Resembling Injected Paraffin in Appearance.**

DR. PHILLIPS reported another case which he said he would like merely to mention because he intended to report it more



fully and intelligently in the fall. This patient, a man, was seen at the Post-Graduate Hospital one week ago Sunday. The patient was a large, robust man, weighing probably 225 pounds, and was an engineer on a locomotive. He gave the history that for two months he had had severe pain over the mastoid. There had been no discharge of pus from the middle ear and no rupture of the drum membrane. An incision was made into the drum membrane, which was followed by a slight discharge of pus. There was no tenderness on pressure, according to the report; there had been no tenderness over the mastoid. Pain had been his chief symptom. On admission to the hospital very slight tenderness could be elicited over the mastoid. He was compelled to give up his work on account of the mastoid pain. One morning he started to vomit, and vomited during the entire day. When Dr. Phillips saw him on Saturday he was rather ashen in color and appeared to be in collapse. His mental condition was not bad, and he answered questions intelligently. There was this continuous vomiting, with not much rise in the temperature, a history of pain in the mastoid, a slight discharge from the ear, with not a great deal of bulging of the drum membrane or the posterior superior canal wall. The man was prepared for operation. The blood examination showed about a 92 per cent polymorphonuclear count. The leucocyte count was from 10,000 to 17,000. The patient rapidly became delirious and could be restrained with difficulty. The house surgeon, without being directed to do so, gave the patient a quarter of a grain of morphin hypodermically. Whether he gave anything else than morphin he could not state. Dr. Phillips was telephoned to and told them to prepare for operation. About 11 o'clock the man was unconscious, whether from the morphin, the middle-ear disease, or a combination of both, he could not tell. He had, however, many misgivings about the administration of morphin at that time. Ether was given by an experienced anesthetist. Upon removing the cortex it was evident that there was very extensive disease in the mastoid. The pus, which was very offensive in odor, did not well up on pressure. Dr. Phillips had never seen a similar condition in the mastoid. It appeared as if the cells had coalesced together. If one could imagine a mastoid with large cells injected with paraffin, he would get an idea of the condition found. It cut like cheese. When he came to the work on the sinus and was proceeding with the excavation,



the blood became very dark in color. Respiration began to get slower and slower all the time, and he was obliged to discontinue the operation and devote his attention to resuscitating the patient. There was no response, and respirations could not be revived. He dilated the sphincter ani, and he did everything that was usually done in such cases, but the respirations would not come up, and the patient died within five or ten minutes, on the table. He was so near the sinus, excavating high up through the antrum, he thought he would continue operating quickly upon the sinus after death. There was no disease in the sinus, but on passing a probe through the attic wall into the cranial cavity, and withdrawing it, there followed a flow of pus. He said he felt quite suspicious, from the character of the granulation tissue, that this might be a malignant case. But a careful examination made of the scrapings gave no such evidence.

DR. DENCH said that three years ago he reported three cases of that character, and he recalled two of these cases distinctly. The entire mastoid process contained masses that looked like paraffin. On examination, these masses were found to consist of cholesterin.

DR. PHILLIPS said that the case he reported was one of chronic suppuration. There was no history of any discharge previous to two months ago. The odor after the part was opened was not that which would be expected in cholesteatoma cases.

DR. DENCH said that they all knew how unreliable the histories given by patients were. Early there might have been a suppurative process followed by cicatrization, and the cholesteatoma might have resulted as a result.

DR. GRUENING, referring to the first case Dr. Phillips reported, said he would like to know whether the treatment on cases of this kind, where the subclavian was injured, or in cases where the jugular vein was injured and the end could not be gotten at, could not be carried on wisely by going further and exposing the subclavian vein thoroughly and tying it. One must use a great deal of material to effect a compression of the subclavian vein at that point. He thought it would be better to expose the subclavian vein and ligate it; that would be the proper treatment.

DR. ADAMS asked Dr. Phillips if he had much trouble in

making sufficient compression there, and when taking out the packing, what happened.

DR. PHILLIPS was unable to say whether the injury was exactly in the subclavian where the jugular emptied into it, or not. They were working well behind the clavicle and working as low as was possible. The injury took place and the flow of blood was tremendous.

DR. ADAMS recalled the case of a Greek who had an operation performed for sarcoma of the neck, and the jugular vein was injured at the time. The man died on the table. Soon after that an operation was done upon a man connected with the institution, and the same thing was done, and that man died on the table. He did not see how any packing could be effectual in controlling such a hemorrhage in the throat. He thought that possibly air might get through the packings.

DR. PHILLIPS said he never saw such a collapse occur as in the patient he reported, and he knew that he saved the boy's life by quick work and by the use of the intravenous injection of normal saline solution. He lived three weeks after the accident.

DR. GRUENING thought that the supposed danger from the entrance of air into the veins was a bugbear.

DR. DENCH said that several years ago several cases were reported and published of the entrance of air into the lateral sinus. He thought there were one or two such fatal cases published.

DR. GRUENING thought that such cases must be very rare.

DR. DENCH replied that they were indeed rare.

DR. PHILLIPS asked if any present had had such an accident happen.

DR. JOHN D. RICHARDS said that he had such an instance happen to him; the vessel was seized with an ordinary clamp and twisted. This controlled the hemorrhage.

With regard to the entrance of air into the jugular vein, one and a half years ago he had a case in which there was an extension of the disease far down below the clavicle, and it was impossible to get to the lower limit of it, so he cut the jugular off below the clavicle. He took a pair of mouse-toothed forceps and introduced them below that point and got out a lot of clot. During the manipulation there was an aspiration of air, whistling in and out. Subsequently at the dressing the same thing occurred.

DR. QUINLAN said that some time ago, in Philadelphia, an experimenter forced an unusual quantity of air into the femoral vein of a monkey with no effect whatever.

DR. DENCH said he saw a case last summer in which he assisted another do an operation in which the lateral sinus was wounded. In that particular case aspiration was heard and respiration stopped. The man, however, was alive to-day. Dr. Dench said that he had opened the sinus many times accidentally and intentionally for the purpose of exploration.

DR. ADAMS said the case he reported was one of sarcoma of the neck, and the lumen of the vessel was wide open.

DR. DENCH said he had torn the jugular vein several times and had never seen any ill results from this accident. In one instance the jugular vein was divided between two ligatures, and the lower one slipped off and nothing happened.

So far as packing to control the circulation there, he did not see why packing down on the first rib would not stop any venous hemorrhage there.

DR. GRUENING, referring to the case reported by Dr. Shepard, said that the question now was, "Where do we stand?" Should we stand by and not do anything in cases of otitic meningitis? He said he had had similar cases. Streptococci were found in the cerebrospinal fluid. He cut down and drew off a great deal of water from the subarachnoid space, and the child got well. There were a number of such cases reported. He did not think we should be silent on this question. He asked for an expression of opinion.

DR. DENCH said that he was much interested in the subject of meningitis. If one took one hundred cases of otitic meningitis at random, forty-five would get well as the result of operation. Leaving out the cases of localized meningitis and epidural abscesses which always get well, there were a number of cases in which the subdural spaces were drained, lumbar puncture having been done, the purulent fluid evacuated, and the cases recovered.

Dr. Dench had seen a number of cases this winter, and every one of them were operated on. There were two cases where he drained the subdural space. In two cases he drained the ventricles. He had a case only last week in which the ventricles were drained. He did a lumbar puncture and later drained the lateral ventricle. The patient lived six days after



drainage was instituted. This operation should be done with strict observance of proper technic. This was an absolutely new field of work. The cases should be divided into two classes, one where the ventricles are involved, the other where the subdural space is involved. The latter cases should do well in every instance.

He was glad that Dr. Gruening brought this question up. He did not believe that these patients should be allowed to die without operative interference.

DR. GRUENING said that he had recently seen reported cases that had been diagnosed as meningitis and nothing had been done.

DR. SHEPPARD said that he had had three or four cases of serous meningitis in which he operated with recoveries. But in those cases in which the cerebrospinal fluid is distinctly cloudy, he confesses that he feels pretty helpless. Most cases of serous meningitis, however, will do well. He asked Dr. Gruening if he had found streptococci in the serous meningitis cases.

DR. GRUENING replied that he had found such an instance but once; streptococci were found in the cerebrospinal fluid in that case. They also would find streptococci in the cerebrospinal fluid in cases where there was no meningitis. There might be an epidural abscess. He thought that in those cases with very severe symptoms, the cerebrospinal fluid would show streptococci in abundance. In some cases operation was refused because the condition was caused by the streptococci.

DR. DUEL said that Balance had spoken of the hopeful position even in those cases where the cerebrospinal fluid was found to be milky and to contain bacteria. This was in line with what Dr. Dench had said. There was a possibility of differentiating different types. The future looked bright for saving cases that now were lost, from want of activity on the part of the surgeon.

DR. PHILLIPS was positive that they should not allow patients to die without making an effort to save them. One or two cases in his service at the Manhattan Eye and Ear Hospital had recovered after operative interference. He thought they should improve their technic. In one of his operations he knew that his technic was bad, but he did better with his next case.



DR. WHITING said that the symptoms must be very pronounced before he would abstain from operation and allow the patient to die without operation.

DR. RICHARDS said he had seen one case that recovered; the cerebrospinal fluid was not examined, but the subdural spaces were, and pus was obtained.

DR. HARRIS said he had had a limited experience with these cases, but he felt, as did Dr. Gruening, particularly after he had read with care an article by Alexander, who took the position of most of those who had spoken. This, however, was not the position assumed by Dr. Sheppard, namely, that operation was indicated when a diagnosis could be made of serous meningitis. Not only in serous but in purulent meningitis operative interference was indicated. He took the position that Dr. Gruening did, that the findings in the cerebrospinal fluid were contradictory. In the presence of turbidity or pus in the cerebrospinal fluid, unless there was some sufficient reason not to operate, he did not believe this to be a contra-indication for entering the cranial cavity.

DR. DENCH said that in one of his cases he did a lumbar puncture in order to remove the immediate pressure. In the fluid was found pneumococci and streptococci. It was the pathologist's idea that the pneumococcus had been able to penetrate the bone, while the streptococcus had not, and, therefore, had become more rapidly diffused. This was a subject that should be studied more. It offered a broad field.

DR. GRUENING said that at one time the position held by Dr. Harris was maintained, but that it had since changed.

#### Removal of Semicircular Canals.

DR. FREDERICK WHITING reported two cases.

Case 1.—This patient was a nurse in the New York Eye and Ear Infirmary, and he saw her about five or six weeks ago. She complained of pain in her ear one Sunday night, and on Monday morning the house surgeon did a myringotomy. During that afternoon and evening there was a purulent discharge from the ear. Dr. Whiting saw her on Tuesday, when there was an extreme degree of tenderness over the entire mastoid. At the same time there was a very profuse purulent discharge from the ear. He expressed the opinion that it would be necessary to operate within twenty-four hours. At midnight she

vomited violently, and had vertigo very pronounced and of a severe type. She could not raise her head at all without immediately vomiting. When the house surgeon saw her in the morning she had a pronounced rotatory nystagmus, and fairly well pronounced vision when the eyes were fixed in the plane of direct vision. But as she turned her eyes to the left side the nystagmus became exaggerated. As she rotated them well to the opposite side, and when the upper lids were drawn from the eyeballs, the nystagmus was extremely pronounced and of violent type. He advised immediate operation, and removed the entire mastoid. The tissues contained a considerable amount of pus, and all the cells were filled with clots, granulation tissue or pus. The intercellular osseous basement substance was not broken down much, for sufficient time had not elapsed for this to occur. He removed the semicircular canals, which were filled with clot. He did not disturb the bony meatus; he did not attempt to detach the lower portion from the bony meatus. He went beneath the arch and opened the vestibule widely. The girl, as soon as she had recovered from the effects of the anesthetic, never vomited again, the nystagmus disappeared within forty-eight hours to seventy-two hours, and her complete recovery was uneventful.

Case 2.—Three weeks later he had a case at the Mt. Sinai Hospital. The patient was sent in because she was suspected as tuberculous, but all the tests made to determine this were negative. But after she had been in the hospital a few days she developed an earache, and the ear drum was incised by the house surgeon. Following this there was a purulent discharge from the ear, which lasted for several days, when the attending physician asked him to see the patient. When Dr. Whiting entered the ward he found her vomiting violently, with her head held over the pus basin, and she had been vomiting for several hours. She could not fix her eyes on anything but that the nausea became intense and she vomited; so she kept her eyes closed and her head buried in the pillow. She had rotatory nystagmus, but of slight degree, when the eyes were fixed in the line of direct vision; but so soon as she turned her eyes away, the nystagmus increased, and as she rotated her eyes to the right the nystagmus became pronounced. When he raised the eyelids from the eyeballs the rotatory movements became so rapid as to defy any attempts to follow the eyeballs. He

did the same operation on this patient that he did on Case 1.

Both of these cases made a perfect recovery. He felt that in those cases early operation saved life. In Case 2 he found in the semicircular canals and vestibule thin, shreddy clots, but there was no actually purulent material that could be recognized as fluid pus. But both vestibule and labyrinth and semicircular canals contained clots. Both the patients made an uninterrupted recovery. He felt convinced that early operation in both these patients saved their lives. He was particularly pleased with the outcome, because he thought that if they had waited a few days longer, both patients would have been lost. These cases had an acute suppurative labyrinthitis. He had operated for chronic suppurations where there had been some recognizable fistula leading to the semicircular canals, and in other chronic cases, where there was no recognizable fistula, but where the symptoms referable to lack of co-ordination and disturbance of equilibrium and the like indicated the necessity for operation; all such cases recovered. These were cases, however, of chronic suppuration.

DR. EMIL GRUENING said that of course all of them had had such cases, and at one time they did not immediately enter the labyrinth. He had had a large number of such cases, with nystagmus, vomiting, dizziness; and in these cases the simple operation of mastoiditis cured the patients of these symptoms.

Last winter at the Mt. Sinai Hospital he met with three cases, all presenting these symptoms, and all were saved. They had nystagmus which was as exaggerated as that described by Dr. Whiting. He did not feel that he did too little by not opening the semicircular canals and labyrinth. He thought it was going a little too far to open every labyrinth in these acute cases with symptoms of nystagmus, dizziness and vomiting. With only clots in the semicircular canals, and no purulent matter, the patients would get well without such an operation. After the mastoid operation, if the symptoms continued, then it may be indicated to do the labyrinthine operation.

DR. JOHN D. RICHARDS believed that Dr. Gruening's position was correct; he did not believe that one could tell from the symptoms alone whether or not the labyrinth was invaded to the surgical extent. Cases presenting symptoms of vertigo, vomiting, nystagmus, if there are no symptoms of meningeal invasion, would get well without this radical operation.



From a surgical standpoint, they were not the cases to be handled. He thought they were operating too frequently, particularly in those cases which gave no symptoms pointing to the invasion of the meninges and giving meningitic phenomena. A large number of cases presenting similar symptoms in the chronic cases would show at operation an old fistula leading to the capsule and labyrinth; after operation, the fistula would disappear. While the labyrinth was invaded in acute cases, it was not invaded to a surgical extent.

DR. ARTHUR B. DUEL believed that it was a grave question about the advisability of early operation in these acute cases; there was great doubt whether there was a suppurative labyrinthitis or not. Nevertheless he felt that sometimes an early operation might save a patient on whom a later operation would prove ineffectual. For instance, in the history of the patient from whom he got the specimen he presented, the best judgment was obtained that could be brought on it; this patient's condition subsequently improved, and he hesitated to do anything further. The labyrinthine symptoms disappeared in forty-eight hours after the operation. Later the temperature rose to 106, and she died. The specimen showed that the infection, in the meantime, had traveled through the labyrinth to the base of the brain. How would it have been had he operated 48 hours earlier?

Dr. Duel said he had in mind a case that Dr. Whiting saw with him a few days ago. The patient had an earache late at night; at 4 a. m. he sent to him and asked what he should put in his ear. Within one hour Dr. Duel opened the middle ear because there was a bulging drum. A smear from the discharge showed pneumococci. The temperature was normal for the following twenty-four hours. Then he was hastily summoned on the following morning, because the patient had been vomiting since 2 o'clock. He was very dizzy, and he could not turn in bed without vomiting. By burying his ear in the pillow he could keep from vomiting; but it recurred on the slightest movement. When he turned on his back and looked straight, there was a marked rotatory nystagmus toward the sound side; when he directed his eyes away from the affected ear the nystagmus became very violent. He had no temperature. He showed complete deafness on that side to tuning fork and voice. A few hours later Dr. Whiting saw



the patient with him. At 5:30 that afternoon, both agreeing that it was wiser to operate, they operated and found that there was no circulation in the labyrinth. Within twenty-four hours the temperature rose to 107 F., and the patient died from a meningitis.

DR. EMIL GRUENING said that Dr. Whiting might have had two successful cases of early operation in acute diseases, but there were hundreds of cases which had recovered without labyrinthine operation. He thought they might induce a purulent meningitis by operating on the labyrinth when there was a purulent condition in the mastoid. He believed that they should refrain from operating upon the labyrinth at first; attack the mastoid, and then a few days later, if necessary, operate on the labyrinth.

DR. DUEL said that Dr. Whiting had examined the fundus in both eyes and found them congested. This had been taken as an added indication for early operative interference.

DR. EMIL GRUENING said that in many cases dizziness and vomiting were not due to labyrinthine disease, but were due to the meningitis; vomiting and dizziness were the first symptoms of a meningitis. If they merely entered the labyrinth they made a great mistake.

DR. WHITING said that Dr. Duel's experience in the case he reported simply corroborated his own views in the matter. He thought that what Dr. Richards said in regard to the chronic suppurative processes was entirely true. Even if one got manifestations associated with deafness, as in the case Dr. Duel saw, it did not give positive indications that the labyrinth was involved; but the probability was that, if there was not a suppurative process at that time, it speedily would become so. If the patient was to have a chance to get well, early operation offered the best chance of all. That was his opinion at the present time.

Dr. Gruening had stated that hundreds of cases recovered without operation, but Dr. Whiting said he was not in a position to question that statement; he simply stated that only within a recent period had they taken note of and observed these cases with any degree of accuracy whatever. If a man stated that he had seen so many cases, he accepted that statement in proportion as his memory was accurate. With a train of certain symptoms associated with tuning fork perception heard only on the opposite side of the head, that was,

when the tuning fork was placed over the mastoid on the affected side the patient indicated its perception in the opposite ear, under these conditions he thought it was a fair assumption to say that there was labyrinthine involvement. From the experience he had had, he felt that in the presence of certain symptoms, with deafness, you had positive evidence of suppurative inflammation of the labyrinth; to open the labyrinth skillfully and promptly, exposed the patient to less risk than if he was left after a simple mastoid operation, in the hope that the process would not go further. The same rules, however, did not apply to the chronic suppurative cases. In many cases, where there had been more or less vertigo, disturbance of equilibrium, these symptoms had disappeared after operation; but that did not mean or prove that the labyrinth was not the seat of suppuration; it meant that it was out of business. Patients might die of meningitis without warning months or even years later. Sometimes he felt that there was urgency in the chronic cases; but in the acute cases he believed they exposed the patient to greater risk in not doing an operation than when they performed such an operation.

DR. GRUENING wished to have it recorded that he did not agree with the views expressed. Those acute cases would present the symptoms of dizziness, vomiting and nystagmus, and when a thorough mastoid operation was done, the symptoms would disappear in the great majority of the cases. In his own experience every case recovered. A large number of similar cases were seen at the Mt. Sinai Hospital; they were not subjected to the labyrinthine operation and all recovered. With this experience he thought they were doing too much when they attacked the labyrinth. In Dr. Whiting's cases there might have been a serous effusion, an hyperemia, or a hemorrhage of the labyrinth; but these conditions did not call for opening the labyrinth.

DR. DUEL asked Dr. Gruening if he recalled some cases in which meningitis rapidly developed following a simple ear suppuration, and death within two or three days.

DR. GRUENING said he had, when there were labyrinthine symptoms. But the symptoms were different. Dizziness and vomiting may be due to the meningitis which causes death. He referred to those cases with nystagmus, deafness in one ear and vomiting. When there was dizziness and nystagmus present, with deafness in one ear, he made a favorable prognosis.







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XVII.

FURTHER OBSERVATIONS ON SOME OF THE  
NEWER THERAPEUTIC MEASURES IN EAR,  
NOSE AND THROAT AFFECTIONS.\*

By JOSEPH C. BECK, M. D.,

CHICAGO.

At the present day, when enthusiasm is so great on account of the success of surgical intervention in our specialty, the nonsurgical measures fail to attract the average man unless positive results can be demonstrated by their employment. Unfortunately, there are but few specific remedies for specific diseases, such as, for instance, mercury, quinin and some of the antitoxins. Nevertheless, the diligent therapist who will conscientiously employ remedial agents which have been given to him by scientific men will find considerable satisfaction from their use.

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\*Read before the American Otological, Rhinological and Laryngological Society (Southern Section), Washington, February 12, 1910.

While it is true that the greater number of chronic affections in ear, nose and throat are only to be relieved by surgical intervention, there still remains room for local and medicinal treatment, as, for instance, where operation is contraindicated by some general condition or where operation is refused. Again, there are remedies to be used in after-treatment to operations, for it can be said without question that even operations do not always occasion the cure.

I have mentioned "chronic affections" because this paper deals with therapeutic measures principally employed in such rather than in acute diseases. It is not my purpose to go into great detail in any one subject, but simply to make a resume of my personal observations in the employment of these various remedial agents, hoping that the discussion will bring out some more points.

I have in previous papers made reports in extenso on several of these remedies; I now present my further observations, believing these to be of value, because every observer is more or less enthusiastic when trying something new, but later he becomes calmer and finds the true limitations of his experiments. I have divided this subject into six groups, as follows:

1. Therapeutic measures in chronic suppurative inflammations.
2. In chronic nonsuppurative inflammation.
3. In destruction of new cell formation or neoplasms.
4. In the production of new cell formation or epithelialization.
5. In the prevention of local and general infection.
6. In the influence of blood coagulation.

#### GROUP I. THERAPEUTIC MEASURES EMPLOYED IN CHRONIC SUPPURATIVE INFLAMMATION.

(a) *Bier's Treatment*.—After a thorough trial of this mode of treatment in chronic suppurative sinusitis, middle-ear supuration and chronic follicular tonsillitis, I can positively state that many of my cases were influenced beneficially. Whether this improvement was due to the induced hyperemia and leucocytosis, or simply to the mechanical removal of the secretion, I am not prepared to say. I make use of the Bier's pump, to which there is attached a stiff-walled rubber tubing, and

to this the various ear, nose and tonsil attachments, as shown in Figure 1. The constriction band around the neck I have abandoned, as it is not so effective as the method employed.

(b) *Vaccine Therapy*.—After two years of faithful application in selected cases of chronic suppuration of the accessory sinuses, middle ear and chronic follicular tonsillitis, I am convinced that positive results or cures can be counted among

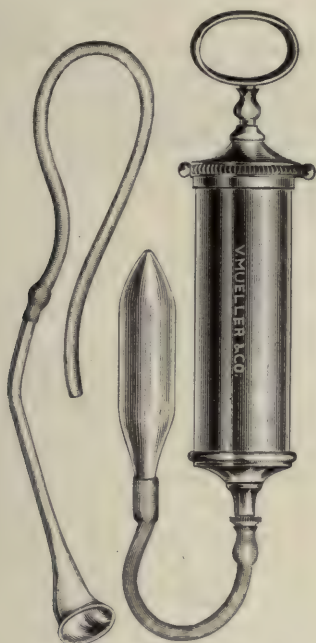


FIGURE 1.

the greatest rarities. I am equally convinced that the employment of vaccines in these conditions, associated with other treatments, is of marked benefit in quite a number of cases. It appears to aid in the healing process as a general tonic, and it is with that point in view that I am making use of the vaccine therapy.

Establishing first the most predominating microorganism present in each individual case by cultures and smears, I

obtain a vaccine of that variety, either by using one made directly from the culture, an autovaccine, or a stock vaccine which is generally of the polyvalent variety. Since the staphylococcus pyogenes aureus, albus, and citreus are the most frequent microorganisms found in these infections, I make use of the stock vaccine of these three types. I have discontinued the aid of the opsonic index and only go by the clinical manifestations, a rule that I have found practical, viz.: making injections about ten days to two weeks apart. It occurs sometimes that an injection is made at the wrong moment, known as the negative phase, when the patient will react locally and generally, so that his condition appears aggravated. This, however, lasts only a short time, when the beneficial results from the injection become manifest.

(c) *Bismuth Paste*.—The application of this remedy requires so much detail in carrying out the technic, filling the cavities of the nasal accessory sinuses and middle ear, that, unfortunately, it has not become popular. Thus far very few reports, except by myself, have been published as to its value or negative results in our special field; but in other fields of surgery there are so many splendid recoveries reported that I cannot help but make the following statement: I have been in personal communication with men who will say that they have treated sinus diseases by the aid of the paste with absolutely negative results, when, on closer questioning, I find that they have attempted to fill the cavities by the aid of a collapsible tube introduced into the anterior naris. Having never read the technic of its application into these cavities, they certainly cannot expect to obtain any results. Again, there are gentlemen, who know all about the technic, who expect results which are impossible and never have been claimed for this treatment. About a year ago I made my first report on my experiments with this remedy, and to-day I can make the following positive statements, after very careful observation:

1. In the routine treatment of filling the cavities of the accessory sinuses and middle ear I use the bismuth paste No. 1, which consists of bismuth subnitrate, 33 per cent, and vaselin, 67 per cent. It does not require heating.

2. The original instrument for injection has been discarded because it was not practical, not made well, and a new one



substituted. (Fig. 2.) This obviates the need of an assistant, is readily filled and the various tips and canulæ are easily attached.

3. The small calibre canula is first introduced into the frontal, sphenoid or antrum, as any other canula would be, and the syringe attached by means of the bayonet joint. When injecting the middle ear the olive tip is used. A small rubber tubing is passed through the small side opening to

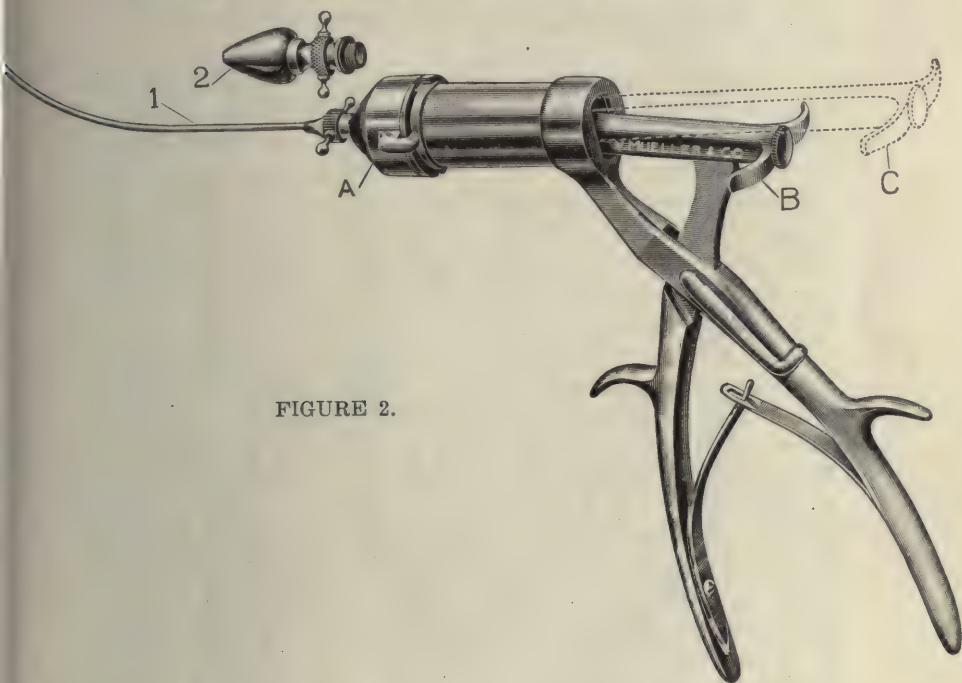


FIGURE 2.

permit the air to escape, and then the paste will return the same way, showing that every crevice as far as the aditus ad antrum has been filled. This I have proved in cases that I have operated on, as well as on a cadaver. The only exception is when there is a large eustachian tube. Then some of the paste will flow into the nasopharynx.

4. When treating a case of chronic sinus disease in which such pathologic changes as polypoid degeneration of the mucosa or eventually necrosis of the bony walls have taken

place, then the use of the paste, as well as any other non-surgical treatment, will have very little curative effect. I can say, however, without the least possible doubt, that while such sinus is filled with the paste there is less discharge and practically no odor.

5. Since the ethmoid cells are the most frequently involved or associated with suppuration of the other sinuses, and since these multicellular structures cannot be treated by the aid of the paste, it goes without saying that the middle turbinated body, as well as the ethmoid cell in most cases, are first removed.

6. The thorough curettment of the antrum and frontal sinuses by external operation (Caldwell-Luc or Coakley), and subsequently filling with paste No. 2, consisting of bismuth subnitrate 30 per cent, vaselin 60 per cent, white wax 5 per cent, paraffin 5 per cent, has been absolutely satisfactory in eight cases out of eleven. I have had the opportunity to open an antrum secondarily, that I had thus treated, and found after five months the cavity was entirely obliterated by a mass of connective tissue.

7. As a primary dressing, after removal of the middle and inferior turbinated bodies, cautery of the inferior turbinated body, cauterizing bleeding septal ulcer, I have never had better results from any other means of treatment than this one. It aids in the clotting of the blood and prevents adhesions from forming. It does not prevent drainage—in fact, aids it—and secretions will not so easily decompose. It is disagreeable to some patients when the paste drops into the pharynx; however, that is only for one treatment, and it cannot be classed as a valid objection. As a primary dressing I use No. 2 bismuth paste, and employ the olive tip attachment to the syringe. Patient closes postnasal space by the act of swallowing.

8. In atrophic rhinitis, dressing after submucous operation, I have discontinued its use, because it is not as good as other accepted methods.

9. Results from chronic suppuration of the ears have not been any more successful by this means of treatment than any other local measure, and the pathologic anatomy is sufficiently well known to explain the reason. At the same time this treatment is certainly as effective as any other palliative

measure, and, as for the odor, I have found that it is very well influenced in many cases by the paste. The objections to the possible blocking of the drainage is absolutely not valid; if anything, the drainage is promoted, and in several hundred injections I have never had the least symptom of retention or of bismuth poisoning by this mode of treatment.

10. It must not be forgotten that injection after a time

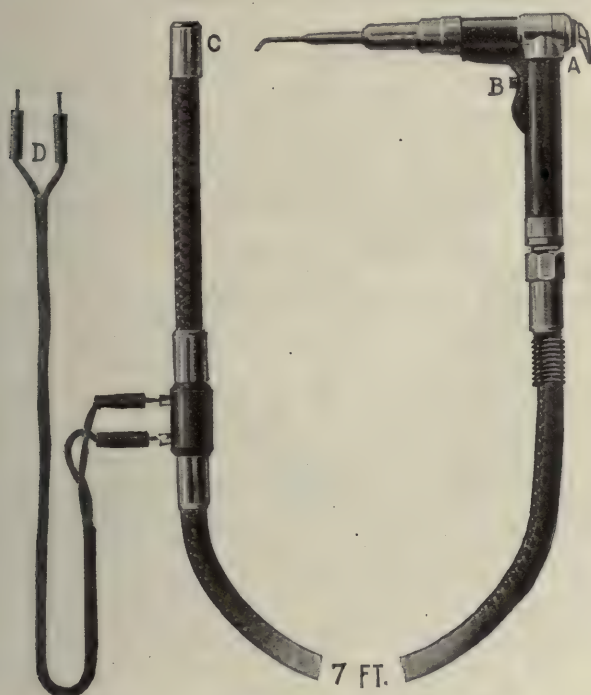


FIGURE 3.

must be suspended, the ear dried and packed with gauze, so that one may see if it is healed. As long as injections are made, there will always be some secretion.

11. In the mastoid operations I have discontinued its use as a primary dressing, but in subsequent dressings I use gauze impregnated with the paste as a packing with good results. Here, too, I stop after a time to substitute either dry gauze

pack or gauze impregnated with scarlet red powder or salve.

12. I have discontinued its use in chronic follicular inflamed tonsils, which I had injected a number of times, owing to the fact that patients were not cured of their repeated acute attacks; I recommend removal of the tonsils.

(d) *Superheated Air or Oxygen*.—About eight years ago I made a report on the use of superheated medicated air in a number of chronic suppurative conditions of the nose and ear, with demonstration of an instrument for that purpose. I had some good results from its use, but inadvertently dropped it, until I began to notice the reports of Prof. Bier, Lermoyez and others, when I again took it up. Instead of using air, I have a tank of oxygen, which has additional therapeutic value. I have also since modified the heating apparatus, using a miniature oven instead of an electric lamp. (Fig. 3.) The air and current pass through one tube, simplifying its handling, and the air and electric current cut-off can be made independently.

I have found this treatment of particular value in the cases where the secretions were thick, scanty and where considerable pain was associated.

I believe that the heat acts as the Bier treatment by hyperemia and leukocytosis, and the oxygen as a possible bactericide.

(e) *Vapor Therapy*.—This very much neglected but valuable therapeutic measure in chronic suppurative diseases of the nose and throat is, I believe, worthy of more attention. In cases of laryngotracheitis suppurativa this treatment is of a special value.

In cases of atrophic rhinitis, especially where the symptom of odor predominates, I have found the use of the vapor of distinct value to control the same.

I employ the Bullings thermo-regulating inhalation apparatus (Fig. 4), which permits of giving the patient different degrees of heated medicated vapor. Compound tincture of benzoin, normal salt solution or Ems water has been the vehicle I used. For the past three months I have experimented with a solution of radium, a radioactive water, but it has not had any better effect than the other remedies..



## GROUP II. THERAPEUTIC MEASURES IN CHRONIC NONSUPPURATIVE INFLAMMATION.

(a) *Fibrolysin*.—In 1902 I reported on the use of thiosinamin in the adhesive inflammations of the middle ear, with the report that the tinnitus aurium appeared to be favorably influenced in some of the cases. I also called attention to the disagreeable symptoms, as well as the painfulness of the alcoholic injection. I was compelled to discontinue its use

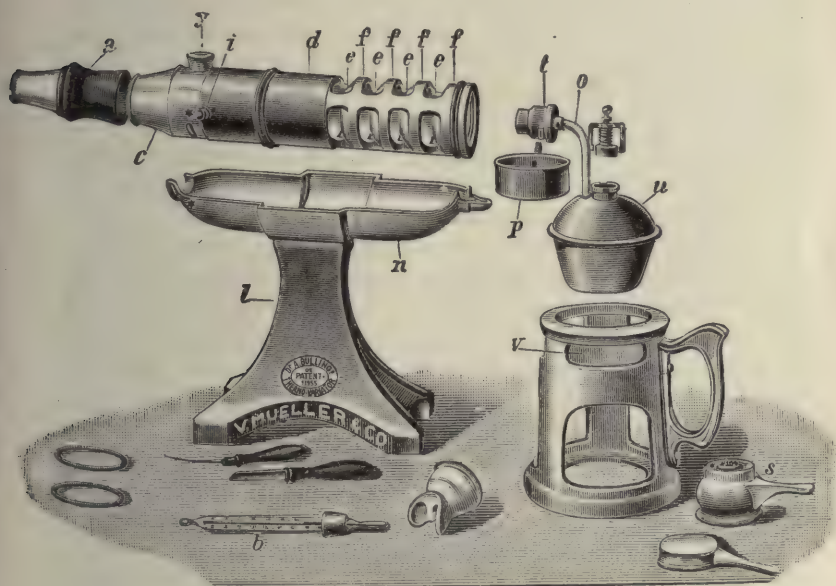


FIGURE 4.

in a great measure. About two years ago Mandl brought out the purer remedy—salicylate of thiosinamin—which he calls fibrolysin, for the same therapeutic purposes. I at once began to use it in my practice, and found it to have none of the disagreeable effects that the pure thiosinamin has. In order to determine the value of this remedy, I have tested each case carefully and controlled these tests from time to time, making exact records. All kinds of middle-ear inflammations of the

adhesive type were treated—that is, recent as well as old, those that had other treatment and those that did not. Also some cases of pure and clearly diagnostic otosclerosis. It is needless to say that they were classified, but it is not necessary for me to make a detail report here. I have also watched with interest reports of this remedy in the nonsuppurative inflammation of the ear by other men (England and Austria), and find great difference between their results and my own in that they seem to be so successful, while my results were far from that. In 48 cases, 876 injections were given into the muscles of the arms. Usually one ampulla every other day. My procedure is as follows: Rx. fibrolysin (Merk's)—one original box (10 ampullæ). Sig.: for physicians' use. The patient's name is written on this box and kept for him only. When the 10 ampullæ are used up (within three weeks), another hearing test is made. A second box is employed in the same way, only at each injection a local treatment, as inflation, etc., is given in addition. At the end of the next three weeks, when the second box is used up, another hearing test is made for control. If no improvement follows at the end of this period, one may put that patient in the class of "doubtful improvement" and continue the treatment for another six weeks. If at the end of that period no improvement follows, then treatment may be discontinued. If it is found, after the one box is used up, that there is a marked improvement, that is, before inflation is employed as an adjunct, the case is in the "curative class," and one may expect definitely good results. The injections in these cases are continued until the patient is cured or until the hearing remains stationary. Unfortunately, this class of cases belongs to the greatest rarities. As to the symptoms of tinnitus aurium and dizziness and vertigo associated with deafness, I can positively state that these symptoms have been markedly influenced in quite a number of my cases. Summing up, I may say that, like so many panaceas for this chronic affection that have been advanced, this, too, falls far below its expectation. If, however, the pathology of adhesive inflammation of the middle ear and secondary labyrinth involvement is correctly interpreted, then this remedy, which is positive and specific in softening scar or connective tissue, is the proper agent to be employed. Of course, the products of the chronic inflammation are ex-

pected to be absorbed, and to this end an addition of idodin has been suggested. My own experience with a remedy, known as tiodin, is given below:

In the cases of pure otosclerosis, four in number, I have had absolutely no result on any of the symptoms after a very long-continued treatment.

(b) *Tiodin*.—This preparation is composed of thiosinamin, pure, and iodine, pure, in ampullæ, the same as the fibrolysin. The technic in the treatment is the same as when using fibrolysin. In nine cases in which I employed tiodin there was absolutely no effect from this treatment, whereas, when, after some months passed, I started with the fibrolysin, I had two cases react favorably, and four more improve considerably. The usual symptoms accompanying the use of thiosinamin or fibrolysin, as burning along the arm after injection, the tired and sleepy feeling, followed by the sense of well-being, were entirely wanting, and I must say that many a time I looked with suspicion on this fine French preparation.

(c) *Dionin*.—This preparation is better known to the ophthalmologist than to the otologist as to its action on the conjunctiva. There it produces an artificial edema lasting from five to thirty minutes. Arguing from analogy, I decided to employ it by injecting it through a Weber-Loehl catheter into the middle ear, and in two cases directly through the perforations into the cavity of the middle ear. I could never observe any such action in the ear as in the eye, nor were there any results from these experiments. I desire to mention this negative result simply because Randall, some time after I had made my experiments, but before I published them, described the action of this agent and his results.

### GROUP III. THERAPEUTIC MEASURES IN THE DESTRUCTION OF CELL FORMATION AND NEOPLASMS.

(a) *X-rays, Radium and High Frequency Currents*.—The employment of these three remedial agents has in the last few years been very much advocated in our specialty in cases of local tubercular diseases and neoplasms, especially the malignant types. I have treated quite a number of cases of glands of the neck, supposedly tubercular, with very slow and not permanent disappearance of them, by the aid of the X-rays; malignant disease, as carcinoma of the auricle, ex-



ternal nose and lip, mouth, tonsil, tongue and larynx, without any effect. Some of these cases were treated also by means of radium of one million radioactivity without the slightest effect. The case of carcinoma of the middle ear, following recurrence after operation, I treated by the high frequency currents and by the method spoken of as fulguration. It was necessary to cocainize the parts thoroughly before treatment, because the sparking required is very painful. This treatment appeared to be effective for a while, but the final outcome was fatal. Therefore I may state that, with the exception of lupus, which is very well influenced by the X-ray treatment, the other affections mentioned are either slightly or not at all benefited by the radioactive treatment in my hands. I may say that this treatment is carried out painstakingly by my radiologist under my care and observation. Furthermore, the one condition that is benefited by the X-ray treatment that I have mentioned, namely, lupus, is much better treated by what I shall next describe.

(c) *Carbon Dioxid (Snow)*.—This remedial agent, principally used by dermatologists for removal of moles, warts and other blemishes, has also been advocated in lupus vulgaris. I have treated one case that resisted all other means of treatment, including the X-ray, which is now practically well by the aid of snow. The technic is to prepare sticks of compressed snow from a tank of carbon dioxid, either in a chamois skin or a specially devised compression apparatus that I use. Pressing these pieces of snow over the affected area firmly for a few seconds (3 to 5) until this area is snow white constitutes one treatment. Different areas are thus treated at one seance. After one week the treatment is repeated, and so on until the condition is either better or worse, when the intervals for treatment will be lengthened. If the parts develop too great an erythema or reaction, one must wait until that disappears, although a certain amount is to be expected. I have also treated successfully by this means a mole of the pinna and a bleeding papillomatous polyp of the vestibule of the nose.

#### GROUP IV. THERAPEUTIC MEASURES TO INFLUENCE COAGULATION OF THE BLOOD.

*Serum*.—It was found that when pure serum or any of the antitoxins of diphtheria or the streptococcic serum are injected



into the system of the patient his blood is more active in clotting. Having noticed some reports of the value of this remedy in grave hemorrhages, I had occasion to try it in a small number of cases. It is very difficult to prove my contention, unless I would have employed the clotting tests by the elaborate methods, but I am quite certain that the cases were very materially influenced by the injection of 10 c. c. of serum, once antistreptococcic and twice antidiphtheric.

#### GROUP V. THERAPEUTIC MEASURES IN THE PRODUCTION OF EPIDERMIS.

*Scarlet Red.*—The interesting experiments that led to the discovery of the action of this remedy are too lengthy to dwell upon here, but I may say that they were scientifically proven and accepted. When a quantity of scarlet red, which is an anilin dye, comes in contact with a granulation surface, and there is in the vicinity an epithelial margin, there will result a positive and rapid migration of epithelial cells.\* After having read of the splendid results in amputation stumps and ulcerations of the leg, I decided to employ it, and am prepared to state that in every instance have I demonstrated rapid epidermization of raw surfaces. The conditions in which I used it are:

1. After-treatment after radical mastoid operation.
2. Small perforations of the tympanic membrane.
3. Small ulceration of the septum, especially after operation in one case of a small perforation, causing whistling.
4. Tubercular ulcer of the skin in an incision following resection of tubercular glands.

The technic is to apply either the powder or a 10 per cent ointment over the area and keeping it in contact for forty-eight hours, when it is again changed. In the perforation of the tympanic membrane there was no trichloracetic acid used.

#### GROUP VI. THERAPEUTIC MEASURES IN THE PREVENTION OF LOCAL AND GENERAL INFECTION.

(a) *Tincture of Iodin.*—This old therapeutic remedy has in the last two years sprung into great prominence in the preparation of the field of operation. I have in all my cases in the last year and a half, just before operation, covered the surfaces with 10 per cent of the tincture of iodine in alcohol without first

scrubbing or washing the parts. If it is an operation of choice, that is, a mastoid, external sinuses, face or neck operation, then the parts are thoroughly scrubbed the day before, but in emergency cases I do not scrub at all—only wash with alcohol and ether, followed by tincture of iodine. There results less infection of the skin after operation. I have lately adopted the practice of painting the mucous membrane of the nose and throat with the tincture of iodine before operating, after the parts are thoroughly cocaineized; also the vestibule of nose and external auditory canal before operating in the nose or ear.

(c) *Urotropin*.—The second remedy is the routine employment of urotropin before and after operations on the nose and ear. Cushing and others of Johns Hopkins Hospital found this remedy of value in preventing and curing infection of the cerebrospinal fluid when given in very large doses, say about 100 gr. daily. They advanced the idea that this drug, in liberating a free formalin in the blood, reached the cerebrospinal fluid and caused it to become less liable to infection.

Since the reports of these gentlemen I have employed urotropin in large doses before and after each operation of the ear and nose, especially mastoid and sinus diseases. The proof that any case of infection was prevented is impossible in my experience, except that I have had no case complicated by meningitis, and some cases that came with this symptom appeared to be beneficially influenced by urotropin.

## XVIII.

### REPORT OF TWO CASES OF BRAIN ABSCESS IN THE FRONTAL LOBE, SECONDARY TO ETH- MOIDITIS AND FRONTAL SINUSITIS.

BY JOHN MCCOY, M. D.,

NEW YORK.

Brain abscess of nasal origin is of comparatively infrequent occurrence, according to a study of the literature of this subject. The writer feels, however, that it is of more frequent occurrence than is generally conceded, and that by a detailed recital of the histories of such cases as come into our practice, be they of favorable or unfavorable issue, we shall be able to recognize the affection at an earlier stage and, therefore, secure increasingly better results, and we shall be able to employ such surgical expediciencies as may have been found useful by other observers. The following cases came into my practice during the past year, and were found to be so absorbingly interesting that a detailed recital was thought worthy of recording. The first case was referred to me on October 15th, 1909, with the following history:

John L.; age, one year six months. The family history was negative as to syphilis, cancer or tuberculosis.

Previous history: Had always been in good health until he had an attack of pneumonia, six weeks before coming to my office. One week after he had been cured of the pneumonia, which lasted about seven days, his left upper eyelid became red and swollen, and three days later the right upper eyelid also became red and swollen. He was seen by an eye specialist, who incised the swelling in the eyelids on the outer and inner aspect of each. The incisions evacuated pus, and the wounds were dressed every other day for six weeks, while a constant discharge of pus came from them. Toward the end of this time the forehead also became edematous. The case was then referred to the writer, and on examination the baby presented the following appearance: Both upper eye-

lids were edematous and each had two fistulous openings which were discharging pus. The forehead was edematous. A probe introduced into the fistulous openings discovered eroded bone. Examination intranasally showed the middle turbinates tightly wedged between septum and outer wall. No pus was to be seen in the nose. A diagnosis was made of ethmoiditis on both sides, perforating the orbital plate, and the child was sent to have an X-ray picture made. The X-ray picture showed the appearance in Figure I. Operation was advised. October 19, 1909, operation was made through the incisions, as indicated in dotted lines in Figure II. First the right frontal and ethmoid region were exposed. While there was not a distinct frontal sinus on either side, still there was a distinct cavity between the outer and inner plates, with a distinct frontonasal duct. The outer plate was found necrotic over this frontal area and extending up on the forehead as high as could be followed through the incision. The orbital plate of the ethmoid was found to have two perforations. The right frontal and ethmoid regions were now thoroughly cleaned out and the left side was next attacked. Here a very similar condition was found, with three perforations in the orbital plate, and extensive necrosis of the frontal and forehead region was found. This side was also cleaned out thoroughly. Then an incision was made from the midforehead region to the vertex, and from the middle of this incision a horizontal incision across the forehead. This incision disclosed an osteomyelitis extending clear up to the vertex, also an epidural abscess on left upper forehead and vertex region,  $1\frac{1}{2}$  inch vertically and 1 inch transversely (See Figure III). The whole diseased area was thoroughly curetted and cleansed and the wounds drained. There was a postoperative rise of temperature to  $103^{\circ}$ , but it subsided to normal in four or five days. The wounds were dressed every other day, and on the tenth day after operation (October 29th) the child left the hospital in good condition, and was brought thereafter to my office for future dressings.

November 6th. Child taking its nourishment well; wounds healing kindly.

November 9th. Child had a spell of vomiting and has been drowsy for past twenty-four hours. At the dressing the right arm and leg seem to be much weaker than left.





Figure 1. Represents area of osteomyelitis as shown on X-ray plate.

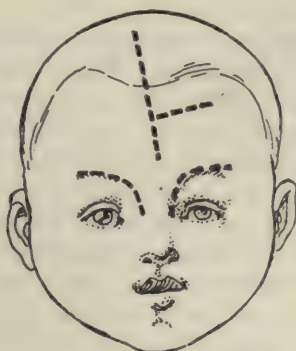


Figure 2. Dotted lines indicate the incisions made at operation.



Figure 3. Represents the area of epidural abscess.

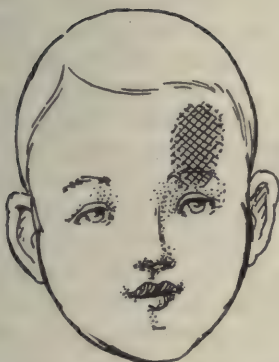


Figure 4. Area of epidural abscess.



Figure 5. Indicates place of counter opening in temporal region.

November 11th. Parents say the right arm and leg were completely paralyzed. Child bright, taking its nourishment well. Wounds healing splendidly. Referred to neurologist.

November 13th. Has been seen by a prominent neurologist, who says there is no indication of intracranial involvement. He thinks the paralysis due to pressure by the dressings upon the brain in the region of the epidural abscess and that it would clear up when the dressings were discontinued. Eye grounds were not examined and no blood count made.

November 17th. Paralysis still continues; baby bright and takes nourishment well. Wounds healing splendidly. Temperature 99.2°.

November 21st. Baby began vomiting in the morning. This continued until the next day, when he sank into coma. The writer was called to the home and found the child in a state of complete coma, pulse 160, extreme pallor, cold extremities.

The baby was immediately removed to the hospital, where the old wounds were first opened, to see if any path into the brain existed. It seemed too bad to have to reopen them, however, they had healed so nicely. The frontal lobe was then entered through the dura, uncovered over the epidural abscess at the original operation. Immediately there gushed forth a great quantity of pus, toward the end mixed with cerebrospinal fluid. On inspection through the encephaloscope it seemed as if the entire frontal lobe had disintegrated. The cavity was packed with iodoform gauze, and under stimulating treatment the child rallied for twenty-four hours, so that when it was dressed next day it was semiconscious. He sank rapidly after this, however, with all the indications of rapid involvement of the ventricles, and died the following day. The pneumococcus was found in the ethmoid pus and in the pus from the brain abscess.

CASE 2.—Herbert E.; age, 10 years. Family history was negative as to syphilis or tuberculosis. Had pneumonia twice when a baby; also has had measles and chicken pox. About July 25th, 1909, began to have pain over the left eye. After suffering with this for four or five days, the upper eyelid became red, painful and very much swollen. This swelling was poulticed for one week at the suggestion of the local physician, and on August 6th the swelling was incised at the

outer angle of the eye. On August 13th he was seen and operated on by a very competent eye surgeon. The frontal sinus was exposed through a Killian incision. The frontal sinus was relieved of considerable pus and thoroughly curetted, together with some anterior ethmoidal cells, and the frontonasal duct was enlarged. A piece of gauze drain was passed down through this duct and allowed to remain. The external wound was completely sewed up and healed by primary union. The gauze drain through the nose was removed little by little in several days. The boy apparently did fairly well for a period of five weeks, having, however, during this time more or less constant headache and intermittent discharge of pus through the initial small incision in the upper eyelid. On September 20th the writer saw the patient for the first time. At this time he had developed a swelling on the left forehead, about one-half inch below the hair line. This swelling was incised, and a large epidural abscess (See Figure IV) was found leading down to and connecting with the frontal sinus. An area of necrotic bone was removed, about  $1\frac{1}{2}$  inches wide and 2 inches long, down to and including part of the posterior wall of the frontal sinus. The dura, which was covered with thick granulations, was curetted and was found to be intact. The wound was allowed to heal by granulation, which it did very kindly, except at the extreme lower end, where a fistula, which led from the frontal sinus down into the ethmoid cells, persisted. During the healing of this wound, however, the headache, which at first disappeared entirely, later come on intermittently. The boy would go for a period of a week or ten days or two weeks, feeling in splendid health, eating well, sleeping well and was very bright and active. Then suddenly he would be attacked with a severe headache referred to the region over the opposite eye. He would become drowsy and have nausea and some vomiting. These attacks lasted for a period of from 12 to 24 hours, and would as suddenly cease, and again the boy become bright and active. His temperature and pulse and urine were normal. This continued until November 18th, when it was decided to more thoroughly remove the ethmoid cells than had been done at the first operation, with the feeling that perhaps there was an epidural collection of pus in this region making intermittent pressure on the dura and discharging through the fistula.

On November 18th the ethmoid labyrinth, in which polypi and granulations were found, was thoroughly removed. A small area of dura was found uncovered over the anterior ethmoid cells. The patient did remarkably well after this operation, and in two days was as bright and alert as usual. On November 24th, however, six days later, he had another spell of severe headache, drowsiness and vomiting, and this continued until the next day, November 25th, when he was seen by a neurologist, as the writer now felt that the trouble was in the brain. When seen by the neurologist, his attack had passed off and the boy was so bright and alert mentally that he decided that there was no brain abscess present. The eye grounds showed slight congestion of the disks. That night, however, the patient had two convulsions, and on the following day the writer felt justified in entering the brain. Accordingly the skin was raised from the dura over the old epidural abscess, near the outer end of the eyebrow. After penetrating the brain for about one-half an inch a large abscess was found, containing about one and one-half ounces of pus. A rubber tube was inserted for drainage and the boy returned to bed. The wound was dressed daily, but he did not do well. The rubber tubing became clogged with brain tissue and the abscess did not drain. Iodoform gauze, covered with gutta-percha tissue, was next tried, and this also seemed to fail, as the boy's condition steadily grew worse. His temperature mounted to  $105^{\circ}$ , his pulse to 140 and his general condition was somnolent or delirious. On the fifth day after opening the abscess a second connecting abscess was found, containing an equally large, if not larger, amount of pus. It extended deeper into the brain and more toward the base. The boy was returned to bed in a very precarious condition. The writer felt that the downward trend of the patient and the second abscess were a result of incomplete drainage of the first, and that if anything were to be accomplished it would be as a result of more efficient drainage. Accordingly on the following day, while the patient was in a very low state—at times it was almost impossible to feel his pulse—a section of bone three-fourths inch in diameter was removed from the side of the skull in the temporal region (See Figure V), about two inches back from the outer end of the eyebrow, and on a line just above it. An opening was then made into the abscess



cavity from this point. Iodoform gauze was now inserted into the abscess cavity both from the front and the side opening. An estimate of the size of the cavity may be obtained from the fact that two strips of gauze, each 12 inches long and 1 inch wide, were almost all packed into it. Practically from this moment on the patient progressed to recovery. The wounds were dressed daily. The cavity was swabbed with peroxide and iodoform gauze inserted in both openings. Two smaller subsidiary pockets were found during the next two weeks, one passing in toward the median line and one passing up toward the vertex. The temperature gradually sank to normal, and the patient gradually recovered the use of all his faculties. At first he was troubled with dreadful nightmares and with loss of memory for recent events, also incontinence of urine during sleep. These, however, have all disappeared. The drainage was entirely withdrawn from the front wound at the end of five weeks and from the side wound at the end of eight weeks. There is a hernia cerebri from the front wound, which at first was the size of a large walnut, but which has gradually diminished until to-day it is the size of a chestnut. There has never been a hernia from the side wound. It was deemed best not to interfere with the hernia from the front wound, as it was impossible to cover it with bone or skin on account of the large removal of bone at the time the epidural abscess was treated.

The eyegrounds were looked at about two weeks after first opening the brain and showed well-marked choked disk. The vision to-day is 20/40 in the right eye and about 5/200 in the left eye.

There was no aphasia at any time during the illness.

A critical review of these two cases leads the author to believe:

1. That the path of infection in both of these cases was by way of necrosis and destruction of the inner plate leading to epidural abscess, and thence to the frontal lobe by way of the blood vessels.

2. That the abscesses both went through a latent period and that the symptoms which ushered in the manifest stage were those of drowsiness, vomiting, and headache, and that these symptoms were intermittent and delayed, because in each of these cases a certain amount of skull had been removed, owing

to the presence of the epidural abscess, and this produced a state of decompression.

3. That because of this the abscess in the first case, insidiously enlarged until it finally invaded the lateral ventricle and therefore produced symptoms so severe and so quickly fatal.

4. That the surgical expedient of making a counter opening in the temporal region in the second case was unquestionably the means of bringing about a favorable issue in that patient.

157 W. 73rd Street.

## XIX.

# OBSERVATIONS ON THE PATHOLOGIC CONDITIONS OF THE NOSE AND THROAT, WITH SPECIAL REFERENCE TO THE TUBAL REGIONS, ASSOCIATED WITH CHRONIC CATARRHAL OTITIS MEDIA.\*

(A STUDY OF FIFTY CASES.)

BY HAROLD HAYS, A. M., M. D.,

NEW YORK.

Among the numerous diseased conditions with which the aurist has to deal, there is none which is so baffling and none which means more to the patient than chronic catarrhal otitis media. It is not my intention in this paper to bring forth any new and startling facts. I shall merely attempt to outline the more important pathologic conditions of the nose and throat which directly influence the tubal regions, and secondarily the middle ear. One other point that I hope to make manifest is that we should not lose sight of the great importance the general condition of the patient plays in almost all middle ear disease. Although we have to treat a local condition, the aurist must have the circumspection and acumen of the internist, and must often look for causes outside of the nose and throat if he wishes to effect a cure.

There are two forms of chronic middle ear catarrh, the latter of which is usually a gradual gradation of the former. The first to which I refer is the adhesive variety, the second, the interstitial variety, where lime deposits occur in the muscular walls of the blood vessels and where osteomyelitic changes occur in the ossicles and their attachments, causing ankylosis. In this series of cases I have made no attempt to differentiate the two conditions, for in the facilities usually offered in the

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\* Read before the Otological Section of the New York Academy of Medicine, January 14th, 1910.

clinics, hearing tests with tuning forks, watch and voice are almost out of the question.

The diagnosis of chronic catarrhal otitis media in these cases was made on simple clinical findings, which may be divided into subjective and objective.

*Subjective Symptoms.*—By far the majority of these patients complained of tinnitus. There were roaring sounds, buzzing, tingling and whispering. In some cases the tinnitus was almost unbearable. In others, the symptoms occurred only at night. The second symptom most often complained of was deafness, which also varied in degree from a slight "hardness of hearing" to almost total deafness. Another important complaint in a few cases was a radiating or neuralgic pain in the temporal region, extending over the eye on to the cheek. Among minor symptoms may be mentioned postauricular pain, cracking in the throat extending to the ears, tickling sensations around the eustachian tube and in the external auditory canal.

*Objective Symptoms.*—The objective symptoms were few. The drum membrane was retracted, it had lost its luster and was more or less opaque. The outlines of the malleus, in relation to the drum, stood out prominently. Watch test showed a diminution of hearing from zero to approximately six inches.

In the study of these cases, I examined about seventy patients.\* I have indifferently taken fifty cases as a basis of classification. Besides examining the ears in every case, the anterior nares were carefully examined, the throat was inspected and the nasopharynx (including, of course, the eustachian openings, prominences and fossa of Rosenmüller), in every instance was examined with the pharyngoscope. In the course of study of these cases, particularly in private practice, the elimination or correction of the pathologic condition found, brought about decided relief.

For the purpose of completely studying and classifying the conditions of the nose and throat which would have any bearing on the catarrhal otitis, I tabulated the appended table. This table includes the sex of the patient, age, the ear or ears affected, nasal abnormalities, throat abnormalities, naso-

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\* The clinic cases were studied in Dr. Lewis' clinic at the New York Eye and Ear Infirmary. I am indebted to him for allowing me to use this material.



pharyngeal abnormalities, condition in the fossa of Rosenmüller, condition of the tubal orifices (the two latter including the promontory), the patency of the tubes and remarks about special cases.

I shall give but a brief resumé of these pathologic conditions which in many instances are responsible for the tubal condition and indirectly responsible for the chronic catarrhal process in the ear.

Fifty cases are tabulated. Of these, thirty-four were males, sixteen females. The age of these patients varied from five years to seventy years, the average being thirty-three years. Dividing the ages into decades, we find in the first, one case; the second, five cases; the third, nineteen cases; the fourth, eight cases; the fifth, six cases; the sixth, nine cases; the seventh, one case; the eighth, one case. The majority of cases, therefore, occurred in the third decade or between the ages of twenty and thirty.

The right ear was affected five times; the left ear five times; both ears, forty times.

#### NASAL ABNORMALITIES.

Out of the fifty cases tabulated there were only four that did not suffer from some pathologic condition in the nares. By far the majority of the cases had some pathologic bone condition, such as a deviated septum or hypertrophy of the turbinates. Naturally, the abnormality was not confined to any one particular part of the nose, but was complex in so far as a deviated septum, for example, was accompanied by hypertrophy of turbinates, hypertrophic rhinitis, accessory sinus disease, etc. As I mentioned before, the pathologic condition in the nose in many cases was directly responsible for an abnormal condition in the nasopharynx, especially around the tubal orifices and therefore indirectly responsible for the catarrhal condition of the ears.

The nasal septum was abnormally deviated, that is, enough to need correction, in twenty-four cases. It was deviated to the right in sixteen cases, to the left in six cases and a marked sigmoid deviation was present in two cases. It will be noted that the majority of patients suffered from a catarrh of both ears, no matter which way the septum curved. On the right side there were five cases where the deviation and the abnormal

condition of the ear corresponded; on the left side, three. This is explained by the fact that the deviation alone was not responsible for the pathologic change. For example, the deviation was accompanied by hypertrophy of the middle turbinates in eight cases, by hypertrophy of the inferior turbinates in one case, by accessory sinus disease in one case. Again we find but two cases suffering from hypertrophy of the middle turbinates unaccompanied by deviated septum. Hypertrophy of the inferior turbinates was present four times, i. e., one case with hypertrophy of both turbinates, one case of hypertrophy of right, one with hypertrophy of left, one associated with deviation of septum (both). Accessory sinus disease was discovered in two cases, one with deviation of the septum. There were seven cases with simple hypertrophic rhinitis and six with atrophic rhinitis, where no bone abnormality was observed. If we add to these the four cases where no nasal abnormality was found, there were seventeen cases which did not need operative treatment.

#### THROAT ABNORMALITIES.

Mention of these cases is made because the tonsil particularly has a direct bearing on a pathologic condition of the tubes.

In this series, the tonsils indirectly affected the ears in ten cases. They were hypertrophic in six cases, atrophic in four. The tonsillar condition was in all cases associated with some pathologic condition in the nose, so that it was impossible to say which was the more responsible. Moreover, this association of conditions produced an abnormal or unhealthy condition of the nasopharynx. In three cases the hypertrophied tonsils were associated with small adenoids in the pharyngeal vault. In the other cases there was usually a congestion or hypertrophy of the mucosa of the nasopharynx. Besides the question of infection and chronic hypertrophy of the pharynx, the enlarged tonsil may cause obstruction by the pushing backward of the posterior pillar of the fauces and by interfering with the muscular action of the tubes.

Four cases showed extreme congestion of the mucous membrane of the throat. One case was associated with congestion of the nasopharynx, the second with a hypertrophic condition, the third with mucus obscuring the entire picture, and the fourth with atrophy and anemia of the membranes around the tubes.

This last case is accounted for on the supposition that the condition had gone on for so long a time and retroactive changes were taking place.

#### NASOPHARYNGEAL ABNORMALITIES.

A survey of the nasopharyngeal condition with which chronic middle ear catarrh is associated, reveals a variety of pathologic pictures, which are more or less familiar. Some of these conditions are an extension process from disease elsewhere, either in the nose or the throat. Such a state of affairs is but natural when one considers that there is a direct contiguity of mucous membrane and that no hard and fast anatomic dividing lines can be made. In other cases, the pathologic condition is more extensive in the nasopharynx than the process from which it in all probability arose in the nose. I refer particularly to the cases of atrophic nasopharyngitis, of which more will be said later.

However, many nasopharyngeal conditions are idiopathic; in other words, the pathologic changes arise from the nasopharynx and are mainly confined to it. Even this statement must be qualified to a certain extent; for abnormalities (of a different nature, perhaps) were found in the nose and throat, which may have been either caused by or been the cause of what I have considered the idiopathic nasopharyngeal condition. I refer mainly to the cases where adenoids were present or glandular hypertrophy, commonly called hypertrophied lymphoid tissue.

The point must here be made that the abnormal conditions in the nasopharynx need not be in close proximity to the tubes in order to cause a middle ear catarrh. For any abnormal condition here present will affect the tube by causing an alteration in its mucosa or by causing an excessive secretion of mucus or by causing the formation of bands in the fossa of Rosenmüller.

The pharyngoscope was an invaluable aid in making these examinations. I was thus able to study closely the pathologic conditions present. In a certain number of cases (about 5%) the nasopharynx could not be seen plainly until cocain was applied to the pharyngeal wall and uvula, which, of course, altered somewhat the picture seen. In one case, there was such extreme laxity of the soft palate and uvula that these



acted as a curtain flapping on the tongue and dropping on the lens of the instrument, thus cutting off any view of the nasopharynx.

Analyzing the cases, we find that there are nine different pathologic pictures of the nasopharynx presented in this series. Of course, there are other conditions which might be added by studying a larger number of cases, such as benign and malignant growths. There were five cases with small adenoids in the vault, extending into one or both fossæ of Rosenmüller, overhanging the eustachian eminence and thus blocking up both tubes. There was one case of a large adenoid overhanging both tubes, eleven cases of atrophic nasopharyngitis, seven cases of hypertrophic nasopharyngitis, one case of granular hypertrophy, six cases of glandular hypertrophy (or hypertrophied lymphoid tissue), four cases with mucus with no ascertainable pathologic condition in the nasopharynx, three cases of simple congestion and one case of extreme hypertrophy of the posterior ends of the inferior turbinates.

The association of adenoids with middle ear disease is so frequent that it is common knowledge that in order to effect a cure of the ears the adenoids must be removed. In these five cases, where the adenoid was small, the primary growth had been sufficient, by the extension of lymphoid tissue, to obstruct one or both tubes. It is apparent that merely the removal of the small growth would be insufficient for the cure of the ear condition. The masses (and adhesions) in the fossa of Rosenmüller and over the eustachian eminences had to be removed. Inattention to this matter has often resulted in the failure of the cure of the patient. These masses often cannot be cleaned out with the curette, but recourse must be had to a small adenoid forceps or the finger. Moreover, it may be necessary in these cases, to continue office treatment for some time, breaking up adhesions, applying caustics, etc. In the case of a large adenoid, like the one mentioned above, the matter is much simpler, as the mass may come away in toto, thus establishing ventilation and getting rid of the offending obstruction. There is another class of small adenoids (which I shall speak of later) that causes no obstruction and merely acts as an irritant in the fossa of Rosenmüller.



## ATROPHIC NASOPHARYNGITIS.

It is rather surprising to see the number of cases of atrophic nasopharyngitis—over twenty per cent. I have classified here all cases in which there is a marked degree of anemia, the presence of tenacious mucus, and marked retraction of the mucosa in the tubal orifices and on the promontory. All of these cases present symptoms and pathologic alterations which are more or less the same. There may or may not be an associated atrophy in the nose and throat. The mucosa presents a peculiar glistening appearance, which is characteristic, but hard to describe. In many instances small tendrils of connective tissue can readily be seen extending from the eustachian prominence into the fossa of Rosenmüller. It is particularly this class of cases which need the attention of the internist, for nothing of lasting benefit can be accomplished in the throat or ear until the body is taken care of. Some of these cases did very well on compound rhubarb and soda mixtures, with some massage of the drums and the application of the silver salts. These two latter procedures were of secondary importance. There were three definite varieties of this condition seen—(1) Atrophic cases with mucus; (2) atrophic cases without mucus; (3) atrophic cases with crusts.

1. *Atrophic Cases With Mucus.*—A large proportion of the cases showed the presence of mucus somewhere in the nasopharynx, varying in character and amount. In many instances, the mucus was thick and stringy, and could only be removed by repeated postnasal douching with alkaline solutions. Strings of mucus could be seen extending from the posterior pharyngeal wall into the fossa of Rosenmüller. Often the eustachian orifices were completely plugged with mucus. It was surprising in the cases where postnasal douches were given to note the immediate improvement in the ear condition without resource to any other procedure.

2. *Atrophic Cases Without Mucus.*—These were the least advanced cases where the atrophic condition could be readily studied on account of the roominess of the nasopharyngeal space. The mucous membrane was extremely pale, glistening and in many cases dry. Either the same condition was present in the nose or a hypertrophic rhinitis of long extent going into the state of atrophy. The eustachian tubes were wide

open, and the fossa of Rosenmüller showed as a deep recess more or less filled in with adhesions.

3. *Atrophic Cases With Crusts.*—Crusting took place only in the advanced cases. But it was precisely in these cases that the tinnitus was so severe as to well-nigh cause insanity. In one case the patient had a movable tongue and was able to clean out his nasopharynx by inserting the tip of the tongue behind the soft palate. In another case the crusts in the region of the eustachian tubes were so thick, heavy and hard that only by prolonged washing and manipulation with an applicator were they dislodged.

#### HYPERTROPHIC NASOPHARYNGITIS.

These cases were characterized by an increase in connective tissue elements and a thickening of the mucosa. There were seven such cases. The mucosa presented a congested appearance, at times was edematous or boggy, and often was thrown into folds between which there frequently lodged some mucopurulent secretion. The reduplication in certain instances extended over the eustachian tubes.

There was one case of so-called granular hypertrophy which was associated with a hypertrophic condition. The mucosa presented a "granulated" appearance, as if it had been sprinkled with fine granules of lymphoid tissue.

Glandular hypertrophy or hypertrophied lymphoid tissue in the nasopharynx was seen more often. Such a condition was observed in six cases. The hypertrophied follicles stood out in isolated patches and often extended well down on the pharyngeal wall. A hypertrophied lingual tonsil was usually present. Adenoid tissue was seen in the vault in some instances. In one case, the eustachian eminences were dotted with lymphoid follicles extending well into the tubal orifices and backward into the fossa of Rosenmüller.

There were four cases with so much mucus in the nasopharynx that no definite examination of the parts could be made. These were all clinic cases, where there were no conveniences for postnasal washing.

The three cases included under the heading "Congestion" were cases where there was no evidence of thickening, but merely an engorged appearance of the mucosa. As soon as the congestion was relieved by appropriate local measures and

depletion of the general circulation, the ear symptoms, at least temporarily, would disappear.

There was one case recorded of hypertrophy of the posterior ends of the inferior turbinates, where the increase in tissue directly infringed on the tubes. This condition probably occurs more frequently than is suggested in this series, more often in association with abnormal conditions elsewhere in the nose.

#### CONDITION OF THE TUBAL ORIFICES.

The pathologic alterations which occur in or around the orifices of the eustachian tubes are, in the majority of instances, but an extension process from lesions elsewhere, either in the nasopharynx or nares. There are some few exceptions to this rule, in which a close study of the eustachian tubes and adnexa shows that the main lesion is confined to these parts.

Let me say here that the pharyngoscope proved its greatest value in the study of these parts. In each case I spent a considerable length of time interpreting the abnormality, sometimes after freeing the nasopharynx from mucus by the post-nasal douche.

The pathologic conditions studied may be divided into six groups:

- |   |          |
|---|----------|
| 1. Congestion .....   | 6 cases  |
| 2. Anemia .....   | 6 cases  |
| 3. Hypertrophy .....  | 10 cases |
| 4. Lymphoid hypertrophy .....                                   | 4 cases  |
| 5. Atrophy .....  | 6 cases  |
| 6. Adenoids .....   | 3 cases  |
| 7. Mucus with an atrophic condition of<br>the nasopharynx ..... | 3 cases  |

1. *Congestion.*—The eustachian orifices and surrounding parts presented a bright red appearance, which quickly disappeared upon the application of cocain and adrenalin. The ears felt "full," and the diminution in hearing and tinnitus were remittent, depending greatly upon atmospheric conditions and the constitutional stability of the patients. At times the eustachian openings appeared merely as small slits in the mucosa, and no deep sulcus could be seen. (Fig. 1.)

2. *Anemia.*—The cases of anemia were in every instance associated with a general anemia. The pathologic process had



not existed far enough to be classified as atrophy. There was some slight retraction. Stimulating applications would temporarily relieve the condition in many cases. But, as I stated previously, these patients needed general treatment, and no amount of "nasopharyngeal meddling" would do any good.

*Hypertrophy.*—Here, again, the cause of the condition was probably not inherent in the nasopharynx. General systemic symptoms brought about a local picture of hyperemia, with considerable thickening of the mucosa, which often was thrown into folds or plications around the eustachian tubes. However, local treatment met with considerable success. The diagnosis of the condition was often made by inserting an applicator through the nose to the eustachian prominence and sounding the mucosa. Observation at the same time with the pharyngoscope revealed an edematous mucous membrane which, when lifted up, showed a deep red, thick, eustachian opening. One case I recall where the mucosa was so thickened that a portion of it sagged down from the left eustachian prominence (Fig. 2), directly closing off the tube. The right tube was normal. The direct application of trichloroacetic acid three times, at intervals of a few days, to the promontory, in a linear streak, by means of an applicator passed through the inferior meatus, caused a decided amelioration of the symptoms.

*Lymphoid Hypertrophy.*—The four cases here recorded showed lymphoid excrescences on the eustachian eminence extending down into the tubal orifice. These small nodules were indefinitely placed, but were discrete and appeared as pinhead thickenings, varying somewhat in size, but never measuring more than a few millimeters in diameter. They were raised above the surrounding parts, and it was plainly evident that they were composed of lymphoid tissue because an associated lymphoid hypertrophy was often present in other parts. The eradication of this tissue, together with the reduction in hypertrophy of the underlying basement membrane, often improved the condition considerably.

*Atrophy.*—I have spoken of the decided "roominess" of the nasopharynx in cases of atrophy. The same "caved-out" appearance applied to the regions around the eustachian orifices. The mucosa was decidedly retracted, was glistening in appearance, pearly gray and often crusts, thick and hard to



remove, were embedded in the eustachian orifices. (Fig. 3.) After the removal of these, one could see far into the eustachian tubes, sometimes as far as a half to one centimeter. The mucosa was sometimes cracked and fissured.

These cases are often relieved or even cured by treatment directly to the eustachian orifices without any effort being made to relieve intratympanic conditions. In fact, in many of these cases which could be followed closely, I found that the cleansing of the tubal orifices, with stimulation of the mucosa and general treatment for the upbuilding of the body, brought about such marvelous results that I let well enough alone and allowed the ears to take care of themselves.

*Adenoids.*—The adenoids mentioned, three cases, were characteristic in that in two of the three cases the masses were only evident in the fossa of Rosenmüller and overhanging the tubes. (Fig. 4.) In one case that I plainly recall, the adenoid was present on the left side only, resembling a fringelike excrescence. (Fig. 5.) A soft adenoid mass in this situation may do as much harm as a hard, organized mass elsewhere, not only because of the blocking up of the tubes, but because of the formation of adhesions resulting in retraction of the mucosa of the tube. Again, the presence of this foreign mass is liable to set up a peritubal inflammatory condition, the ultimate outcome of which is hyperemia or atrophy.

*Mucus With an Atrophic Condition of the Nasopharynx.*—Mention is merely made of these cases which have been described under atrophy (vide above). They were clinic cases, where the condition of the ears seemed to be due, in part at least, to the formation of crusts in the tubal orifices.

#### CONDITIONS IN THE FOSSA OF ROSENMUELLER.

*Adhesions.*—The presence of adhesions in the fossa of Rosenmüller is a condition very often present, but very often overlooked. In the fifteen cases cited in this series the adhesions were actually seen with the pharyngoscope. Their importance in the causation of chronic middle ear catarrh has been brought out by Bryant, Packard and others.

The adhesions that are seen show as fine fibrillary bands extending across the fossa from the mucosa of the eustachian eminence, backward and downward on to the pharyngeal wall. (Fig. 6.) As a rule, there is some retraction of the tubal mucous membrane.

I am of the opinion that adhesions are present in the fossa of Rosenmüller in all cases of chronic catarrhal otitis media. I have seen many cases where the catarrh was on one side only and adhesions present only on that one side. Where adhesions are not evident by pharyngoscopic examination, their presence may be made manifest by inserting the finger into the posteustachian recess. The fossa often extends downward and outward one to two centimeters, and the depths cannot be seen, but can be readily felt.

The breaking down of these adhesions will in many cases give great relief, and, in some instances, cures. Cocainization of the parts is unnecessary. The finger, corresponding to the fossa to be examined, is inserted deeply into the fossa and swept from above downward. To keep the adhesions from reforming I have, in some cases, been able to insert a piece of corgile membrane behind the tube, allowing it to remain there as long as possible.

In forty-four of the cases examined the tubes were found open in thirty-four cases, closed in eight. The only method used to determine this factor was catheterization. If air entered the middle ear, I considered the tube open. In two cases, one tube was open, the other closed. Of course, it is possible in some cases, where there was no perceptible drum vibration, that my technic in catheterizing was at fault. However, I believe that in many of those cases where air was forced into the middle ear, the catheter or the cocain used before instrumentation was largely responsible in establishing a temporary and unnatural patency.

I have attempted in this paper to bring out the important bearing that abnormalities of the nose and throat have in causing and increasing a middle ear catarrh. Although statistics as such are unreliable, I believe that in this series of cases we have been able to see many of the major pathologic conditions which impair the physiologic action of the eustachian tubes, secondarily resulting in the alteration in the sound-conducting apparatus of the middle ear.

The drawings were kindly made for me by Dr. Percy H. Fridenberg. I take this occasion to thank him.

11 West 91st Street.

No.	Case.	Age.	Ear Affected	Nasal Abnormalities.	Throat Abnormalities.	Nasopharyngeal Abnormalities.	Condition of Fossa of Rosenmüller.	Condition of Tubal Orifices.	Tubes Patent.	Remarks.
1.	S. S. (M.)	17	R.	Septum dev. to right.	Hypertrophied tonsils.	Small adenoid.	Adhesions.	Mucus.	Yes.	
2.	S. S. (F.)	35	L.	Septum dev. to left.	Atrophied tonsils.	Atrophic.		Atrophy.	Yes.	
3.	F. M. (F.)	19	R.	Septum dev. to right. Hyper. mid. turbs.	Hypertrophied tonsils.	Small adenoid.	Adhesions.	Mucus.	Yes.	
4.	A. S. (M.)	50	B.	Septum dev. to left. Hyper. mid. turbs.		Atrophic.		Thick tenacious mucus.	No.	
5.	J. M. (M.)	45	B.	Atrophic rhinitis.		Atrophic.	Adhesions.	Tubes anemic, high, narrow and dry.	Yes.	
6.	M. G. (F.)	5	B.	Hypertrophic rhinitis.		Hypertrophic.		Tubes small and congested.		
7.	J. S. (M.)	20	B.	Hypertrophic rhinitis.	Hypertrophied tonsils.	Small adenoids overhanging both tubes.	Adenoid tissue.	Overhung by adenoid tissue.	No.	
8.	S. G. (M.)	49	B.			Granular pharyngitis.	Adhesions.	Hyper. lymphoid tissue over tubes.	No.	

No.	Case.	Age.	Ear Affected.	Nasal Abnormalities.	Throat Abnormalities.	Nasopharyngeal Abnormalities.	Condition of Fossa of Rosenmüller.	Condition of Tubal Orifices.	Tubes Patent.	Remarks.
9.	M. H. (M.).	46	B.	Spur—left.	Congestion.	Congestion.			No.	Difficult to pass catheter. Absolute deafness.
10.	G. I. (M.)	20	B.	Septum dev. to right.	Congestion.	Atrophic.	Mucus.	Narrowed; Anemic.	No.	
11.	H. K. (M.)	27	B.	Hyper. mid. turbs.			Adhesions.	Hypertrophy.	Yes.	
12.	J. G. (M.)	19	B.	Hypertrophic rhinitis.		Small adenoids.			Yes.	
13.	E. K. (F.)	34	B.	Septum dev. to right.		Atrophic.	Adhesions.	Pale, retracted.	Yes.	Dev. corrected with improvement.
14.	J. E. (M.)	39	B.	Hypertrophic rhinitis.		Congestion.		Hypertrophy.	Yes.	
15.	E. W. (M.)	21	B.	Accessory sinus disease.		Thick mucus.	Mucus.	Hypertrophy.	Yes.	
16.	M. M. (M.)	41	R.	Dev. septum to right.		Congestion.	Mucus.	Lymphoid hypertrophy.	No.	



17.	E. B. (F.)	55	R.	Dev. septum to right.	Atrophic.	Atrophy:	Yes.	Cured after submu- cous resection.
18.	J. L. (M.)	26	L.		Adenoid.	Adenoid tissue.	Retracted.	Yes.
19.	B. P. (F.)	20	B.		Large adenoid.	Adenoid tissue.	Tubal orifices closed by adenoids.	No.
20.	R. G. (F.)	50	B.	Hypertrophic rhinitis.	Hypertrophied lymphoid tissue	Adhesions.	Congestion.	Yes.
21.	D. R. (M.)	34	B.	Atrophic rhinitis.	Atrophic.		Lymphatic hypertro- phy.	Yes.
22.	A. O. (M.)	21	L.	Hyper. inf. turbs.	Hyper. post. ends inf. turbs.		Atrophy.	Yes.
23.	B. W. (M)	50	B.	Atrophic rhinitis.	Mucus.	Mucus.	Hypertrophy.	Yes.
24.	J. H. (F.)	43	B.	Hyper. mid. turbs.	Hypertrophic small adenoid.	Tenacious mucus	Congestion.	Yes.
25.	B. W. (F.)	50	B.	Dev. septum to right.	Curtain of soft palate over- hanging poste- rior nares.			
26.	L. D. (M.)	35	B.	Dev. septum to right. Hyper. mid. turbs.	Congestion. Hypertrophied tonsils.	Mucus.	Hypertrophy.	Yes.

No.	Case.	Age.	Ear Affected	Nasal Abnormalities.	Throat Abnormalities.	Nasopharyngeal Abnormalities.	Condition of Fossa of Rosenmüller.	Condition of Tubal Orifices.	Tubes Patent.	Remarks.
27.	M. I. (M.)	20	B.	Sigmoid dev. of septum. Hyper. mid. turbs.					Yes.	
28.	W. B. (M.)	37	B.	Hyper. inf. turb. (L.)		Lymphoid hyperplasia.	Mucus.	Lymphatic hypertrophy.	Yes.	
29.	M. T. (M.)	23	B.	Hypertrophic rhinitis.	Congestion.	Mucus.	Mucus.	Mucus.	Yes.	
30.	S. T. (M.)	30	B.	Dev. septum to left.			Adhesions.	Enormous hypertrophy of both eustachian eminences.	Yes.	
31.	Y. B. (F.)	50	B.	Atrophic rhinitis.		Atrophic.		Atrophy.	Yes.	
32.	C. K. (F.)	23	B.	Septum dev. to right.			Adhesions.	Retraction.		Improvement after submucous resection.
33.	A. C. (F.)	19	B.	Atrophic rhinitis.		Atrophy.	Adhesions.	Atrophy.	Yes.	
34.	J. B. (M.)	35	B.	Dev. septum to right.		Hypertrophied lymphoid tissue.		Retraction of tube.	Yes. (L.) No. (R.)	

35.	R. A. (F.)	44	B.	Dev. septum to right. Hyper. mid. turbs.		Hypertrophic.	Mucus.	Hypertrophy.	Yes.	
36.	P. A. (M.)	53	B.	Sinus disease.	Buried tonsils.	Hypertrophy.	Adhesions.	Congestion and mucus.	Yes.	
37.	A. L. (M.)	24	B.	Dev. septum to right. Hyper. mid. turbs.		Glandular hypertrophy.		Congestion.	Yes.	Improvement after submucous resection.
38.	A. B. (M.)	60	B.	Sinus disease with polypi. Dev. septum to right.		Thick mucus.	Mucus.	Mucus. Hypertrophy.	No.	No improvement after submucous and sinus operations.
39.	L. B. (F.)	20	B.	Hyper. inf. turbs.	Hypertrophied tonsils.	Glandular hypertrophy.		Hypertrophy.	Yes.	
40.	F. C. (M.)	25	B.	Hypertrophic rhinitis. Dev. septum to right.	Buried tonsils.		Adhesions.	Small adenoid over left tube.	Yes. (R.) No. (L.)	
41.	W. C. (M.)	16	B.	Sigmoid dev. septum. Hyper. inf. turbs.		Hypertrophic.	Mucus.	Congestion.	No.	Submucous resection. Inf. turbidectomy. Improvement.
42.	C. L. (M.)	22	L.	Dev. septum to left. Hyper. mid. turbs.		Hypertrophic.	Adhesions.	Congestion.	Yes.	Submucous resection. No relief.
43.	J. F. (M.)	59	B.	Dev. septum to right.					No.	

No.	Case.	Age.	Ear Affected	Nasal Abnormalities.	Throat Abnormalities.	Nasopharyngeal Abnormalities.	Condition of Fossa of Rosenmüller.	Condition of Tubal Orifices.	Tubes Patent.	Remarks.
44.	S. G. (F.)	20	B.	Dev. septum to left. Hyper. mid. turbs.	Hypertrophied tonsils.	Hypertrophic.	Mucus.	Hypertrophy.	Yes.	
45.	M. L. (M.)	52	B.			Atrophic.	Adhesions.	Atrophy and retraction.	Yes.	
46.	H. M. (M.)	70	B.	Atrophic rhinitis.		Atrophic.	Adhesions and mucus.	Anemia and atrophy.	Yes.	
47.	J. M. (M.)	24	L.	Angular dev. septum to left.					Yes.	Submucous resection. Cured.
48.	F. N. (M.)	20	R.	Dev. septum to right.		Glandular hypertrophy.	Mucus.	Hypertrophy.	Yes.	Submucous resection. Cured.
49.	J. S. (M.)	29	B.	Hypertrophic rhinitis.	Buried, atrophic tonsils.		Mucus and adhesions.	Anemia and retraction.	Yes.	
50.	F. C.	24	B.	Hyper. inf. turbs.		Gland. hyper.	Adhesions.	Small adenoid.	Yes.	



## SUMMARY.

Number of cases.....	50
Males .....	34
Females .....	16
Age:	
Youngest .....	5 years
Oldest .....	70 years
Average age .....	33½ yrs.
Number of patients in each decade:	
1 to 10.....	1
10 to 20.....	5
20 to 30.....	19
30 to 40.....	8
40 to 50.....	6
50 to 60.....	9
60 to 70.....	1
70 to 80.....	1
Ear affected:	
Right .....	5
Left .....	5
Both .....	40
Nasal abnormalities .....	46 cases
Deviations of the septum.....	24 cases
Right .....	16
Left .....	6
Sigmoid .....	2
Deviation of the septum associated with:	
Hypertrophied middle turbinates.....	8 cases
Accessory sinus disease.....	1 case
Hypertrophied inferior turbinates.....	1 case
Hypertrophied middle turbinates.....	10 cases
Associated with deviation of septum.....	8 cases
Hypertrophy of inferior turbinates:	
Both .....	1 case
Right .....	1 case
Left .....	1 case
Associated with deviation of septum.....	1 case
Accessory sinus disease.....	2 cases
Associated with deviation of septum.....	1 case
Hypertrophic rhinitis .....	7 cases
Atrophic rhinitis .....	6 cases
Cases not needing intranasal operative treatment.....	17
Throat abnormalities .....	14 cases
Hypertrophied tonsils .....	6 cases
Atrophied and buried tonsils.....	4 cases
Congestion of throat.....	4 cases
Nasopharyngeal abnormalities .....	39 cases
Small adenoid in vault (usually blocking up one or both tubes).....	5 cases
Large adenoid (overhanging both tubes).....	1 case
Atrophic nasopharyngitis .....	11 cases
Hypertrophic nasopharyngitis .....	7 cases
Granular hypertrophy .....	1 case
Glandular hypertrophy or hypertrophied lym- phoid tissue .....	6 cases

Mucus in pharyngeal vault with no ascertainable pathologic condition in the nasopharynx .....	4 cases
Congestion of nasopharynx .....	3 cases
Hypertrophy of posterior ends of inferior turbinates.....	1 case
Condition in fossa of Rosenmüller.....	33 cases
Adhesions .....	15 cases
Mucus .....	13 cases
Adenoid tissue .....	3 cases
Mucus and adhesions.....	2 cases
Condition of the tubal orifices.....	37 cases
1. Congestion .....	6 cases
2. Hypertrophy .....	10 cases
3. Lymphoid hypertrophy .....	4 cases
4. Adenoids .....	3 cases
5. Atrophy .....	6 cases
6. Anemia, dry, narrow, retracted.....	5 cases
7. Mucus .....	3 cases

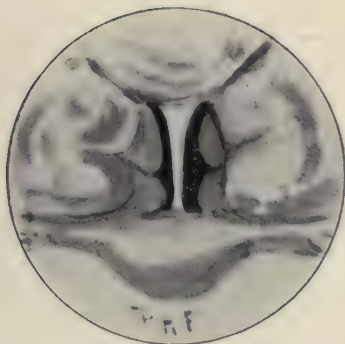


Figure 1. Congestion of the mucosa of the eustachian tubes and adnexa. The tubal orifices show merely as slits in the mucous membrane.



Figure 2. Prolapse of the mucous membrane of the left eustachian eminence, completely shutting off the tube. Cure effected by streaking the mucosa with trichloroacetic acid.



Figure 3. Atrophic nasopharyngitis, showing crusts in the vault and around the tubes. This illustrates the "roominess" of the nasopharynx and the caved-out appearance of the tubes.







Figure 4. Small adenoid directly overhanging the left tube.

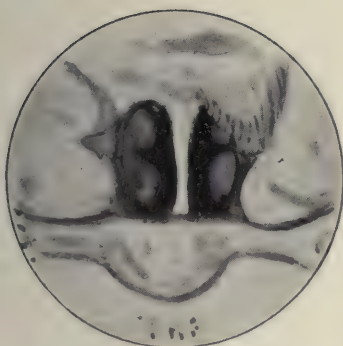


Figure 5. Fringe-like adenoid in the left fossa of Rosenmüller, which caused retraction of the tubal mucosa on account of the presence of intra-adenoid adhesions deep in the fossa.



Figure 6. Fine fibrillary adhesions in the fossa of Rosenmüller extending into the vault and down on to the posterior pharyngeal wall.



## XX.

### THE CLASSIFICATION OF MIDDLE AND INTERNAL EAR DISEASES.\*

By S. J. KOPETZKY, M. D.,

NEW YORK.

The need of a simple, logical and clearcut classification of ear diseases must be apparent to any of us who has consulted the standard American and foreign text books on otology.

The literature holds conflicting descriptions of lesions classified differently by individual authorities, who for the most part have made up their classifications partly from clinical pictures and partly from pathologic data.

Ear conditions were observed and studied, in the first place, entirely from the standpoint of symptomatology; secondly, a series of symptoms which arose from a circumscribed anatomic part of the whole ear, derived its name from the part seemingly mostly affected; it is furthermore noteworthy that the actual comprehension of the pathologic process evoking the clinical picture was a later study to observations obtained from the varying clinical pictures which patients having ear disease presented, and with the acquisition of the newer pathologic knowledge, old clinical terms sanctioned by usage were kept in use.

To these factors add the rapidity with which otology has developed within the extremely short period of recent years, and the causes for the confusing descriptions and terms in the current classifications will be better understood.

A classification, to stand the test of time and experience, must possess certain elementary basic facts which sharply differentiate the various conditions scheduled, one from another. To group a number of diseases, all affecting one organ of special sense—the ear—upon clinical data presented by symptoms of its involvement, that is, to form a schedule of dis-

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\*Read before the Section of Otology, New York Academy of Medicine, February, 1910.

eases upon symptoms, does not permit of sharply marked divisions, because the diseases attacking this one organ will naturally have many symptoms which are common to different lesions.

Again, the grouping of the diseases must be constant and permanent, irrespective of the stage of the disease when it is observed. Grouped clinically, this is not possible, for the picture necessarily changes as the disease progresses in its course, and a varying picture is observed when the disease is studied in different periods. (This seems self-evident, yet we still find classifications in recent text books which divide acute middle ear inflammations into acute perforative and acute non-perforative.)

Furthermore, a classification of diseases affecting one organ, to be practical, must group the diseases having common factors together. Regarding ear disease, a critical study demonstrates that this requirement is met by taking account of the etiologic factors of the lesions involving the ear.

Finally, the classification must be logical; it must show at a glance the interrelationship, the sequence of development, and the usual termination of the conditions thus classified.

A classification based upon actual lesions presented meets all the essentials enumerated above. The pathologic lesion is constant for the given condition; the causative factor inducing the lesions permit of an easy grouping; comprehension of the development of the lesions, tends toward a knowledge of sequelæ and a better understanding of symptomatology, and finally the lesion itself suggests the indicated medical or surgical therapeutic measures.

The classification presented herewith is therefore based upon ascertained pathologic facts.

Before discussing the details of the classification, a definition of the generic terms employed therein is in order.

The term "catarrh" has the sanction of usage and therefore is retained. It is here employed as an appellation possessing in itself no pathologic significance. It is held to be simply a name given a series of processes in the middle ear which are of a physical or a mechanical nature, and which are caused by factors situated away from the tympanic cavity proper. By "inflammation" is meant the reactionary phenomena, pathologically understood, which body tissue exhibits toward bac-



terial invasion. We are aware that, pathologically speaking, inflammations are the result of other agents besides pathogenic microorganisms. But we dislike the division of inflammation into simple and infective types, since in the condition with which we are called upon to deal, excepting possibly the early stages of otitis media neonatorum—a simple inflammation caused by foreign body irritants—all are of the infective inflammatory type. Our use of the term “inflammation” has therefore this meaning. By the term “general conditions” is meant the group of lesions which are the locally manifested signs of a general constitutional disease or condition, limited in its applicability to our present knowledge of these diseases and their characterizing lesions.

Finally, in order to make our divisions and groupings clear, certain facts regarding ear diseases must be conceded to be definitely established. The recognition of otosclerosis as a local manifestation of a general condition, postembryonal in nature, and characterized by a spongification of the labyrinthine capsule and new bone deposits at and around the footplate of the stapes, as held by Denker, Siebenmann and others, is one such pathologic fact.

That this disease has no connection with chronic catarrhal otitis media, pathologically speaking, is another fact.

We must acknowledge that acoustic nerve deafness, while possibly occurring as a terminal, and a secondary lesion to chronic catarrhal otitis, is often a distinct primary lesion, the local manifestation of various constitutional and therefore general conditions.

Finally, we must concede that the normal tympanic cavity is sterile, as held by Preysing; and that the ciliated epithelium of the eustachian tube keeps it sterile under the ordinary conditions of health, and that the causative factors of inflammatory reactions of the middle ear and its adnexa are pathogenic microorganisms.

With these facts established, the diseases of the middle and internal ear divide into three groups, basing the divisions upon etiologic factors, as follows:

1. Catarrhs.
2. Inflammations.
3. General conditions.

A glance at the definition of terms given above will explain

the reason for their employment. Suffice it here to call attention to the absence of bacterial infection or infective inflammatory reaction in all the processes here classified as "catarrhs."

The primary incident, causing these "catarrhs" of the middle ear is located in the nasopharynx and the eustachian tube, and the phenomena we observed in the tympanic cavity is the mechanical resultant from a loss of patency of the eustachian tube and consequent failure of adequate aeration of the tympanic cavity. Noteworthy in connection with the so-called "catarrhs," in this classification, is the fact that the fluid sometimes noted in the tympanic cavity, in the acute cases, is in no sense the result of infection. It never is created in excess of the capacity of the tympanic cavity, and consequently there never is a bulging drumhead in the catarrhal cases. The fluid is the result of negative air pressure within the tympanic cavity, and to distinguish it from the purulent and mucopurulent fluid present in the inflammation it is termed a transudate in contradistinction to the exudate in the bacterial infections.

The catarrhs are subdivided into types of cases as follows:

A. *Acute Otitis Media Catarrhalis* (inclusive of the subacute form, which only differs from the acute in degree rather than type).

B. *Chronic Otitis Media Catarrhalis*.—The tubotympanic and tubal catarrhs of recent literature are grouped in these two divisions, since the catarrhal phenomena of any part of the tympanic cavity or adnexa, receive the generic name, "otitis media."

Inflammations of the middle ear structures are divisible into three classes of diseases, with their respective subtypes, as follows:

*Inflammation.*

1. *Acute Otitis Media Purulenta.*

- (a) Type affecting the new-born (otitis neonatorum, a non-infective inflammation).
- (b) Type involving only mucous membrane.
- (c) Type involving both mucous membrane and bone.

## 2. *Acute Mastoiditis.*

- (a) Type without pain or marked constitutional symptoms.
- (b) Type with pain and constitutional symptoms (classical signs).

## 3. *Chronic Otitis Media Purulenta (Chronic Mastoiditis).*

- (a) Type which is not dangerous.
- (b) Type which is dangerous (intracranial lesions threatened).

An additional word is necessary to place certain conditions still considered independent diseases to show where they are scheduled in this classification. Myringitis, acute and chronic, is an inflammatory condition due to bacterial infection of the tissues of the drumhead. It is rarely a primary lesion. The drumhead is the lateral (outer) wall of the tympanic cavity, and an infection of any part of this cavity is either an acute or chronic inflammation, and hence should be classified under the generic term "otitis media purulenta." Myringitis does not merit consideration as a separate disease. It would be just as logical to describe an ulcerative process in the mucous membrane over the promontory by a special term. Again, when the drumhead is affected secondary to a lesion of the external auditory canal, that is, in the course of an otitis externa, it is simply a coincidental lesion to the otitis externa.

When, on the other hand, it does occur as a primary disease, from trauma, it should be considered as an accidental lesion, and traumatic injuries necessarily cannot be classified logically. As a trauma, the result of direct or indirect violence, the tissue either becomes infected or remains clean. On the one hand, the lesion should be considered a simple incised, punctured or lacerated wound of the drumhead. On the other hand, if infected, it is an inflammation of a wall of the tympanic cavity and therefore, for reasons given above, should be classified as an otitis media purulenta.

I shall later, under remarks on the pathologic lesions here classified, outline the reasons for the subdivision into types as enumerated above.

Under General Conditions we group all those ear diseases and conditions, more or less independent of each other, which

show a constitutional basis, as for instance, the ear symptoms of tabes; those arising from the excessive use of tobacco, alcohol, or the ingestion of mineral or vegetable poisons, as quinin, or sodium salicylate; and those which result from the effect of toxins and general sepsis.

Under this heading we also group the "occupation-neuroses" affecting the ear. Roughly speaking, all these constitutional conditions result in an acoustic nerve deafness, which we use as the generic term for all these conditions.

Finally, under the heading of General Conditions, we find otosclerosis, in accordance with the views of Denker and Siebenmann. It is a general condition having local lesions, which, as far as these authorities have been able to demonstrate, is of a prenatal origin, and characterized by lesions which, according to Shambaugh, seem to follow the blood vessels of the labyrinthine capsule.

In a subsequent paper, I intend to carry this classification further, in an attempt to correlate the intracranial complications upon a system similar to the one here presented.



# THE CLASSIFICATION.

Middle and Internal Ear Diseases and Their Complicating Lesions.	Division by Causative Factor.	Types and Names of Diseases.	Classification of Subdivisions and Subtypes.	Characteristic Otoscopic Finding.	Location of Characteristic Lesion.	Characteristic Symptoms.	Complications and Termination.
	I. Catarrhs.... (Produced mechanically.)	1. Acute Catarrhal Otitis..... (Subacute Catarrhal Otitis.)	..... .....				

# THE CLASSIFICATION.

Division by Causative Factor.	Types and Names of Diseases.	Classification of Subdivisions and Subtypes.	Characteristic Otoscopic Finding.	Location of Characteristic Lesion.	Characteristic Symptoms.	Complications and Termination.
Middle and Internal Ear Diseases and Their Complicating Lesions.	II. Inflammations.... (Bacterial origin)	1. Otitis Media Purulenta. Acuta..... (Mucous membrane involved only.)	A. Otitis Media Neonatorum... Bulging, red, drumhead; perforation.	Amniotic fluid in middle ear spaces.	Discharge (late).	Bacterial invasion—M. P. A.
			B. Otitis Media Purulenta Acuta..... (Mucous membrane involved only.)	Pus and microorganisms in middle ear spaces. Hyperplastic inflammation of mucous membrane lining tympanic cavity.	Pain, otorrhea. Temperature (in children). Transient deafness.	Any type of acute mastoiditis with or without its complicating lesions (usually not common).
			C. Otitis Media Purulenta Acuta..... (Bone and Mucous Membrane involved.)	Pus and microorganisms in middle ear spaces. Inflammation of mucous membrane lining same, and bone destruction in aditus ad antrum.	Pain, discharge. Temperature (in children). Transient deafness.	Any type of acute mastoiditis with or without complicating lesions, promptly subsides unless drainage is established.

# THE CLASSIFICATION.

Division by Causative Factor.	Types and Names of Diseases.	Classification of Subdivisions and Subtypes.	Characteristic Otoscopic Finding.	Location of Characteristic Lesion.	Characteristic Symptoms.	Complication and Termination.
Middle and Internal Ear Diseases and Their Complicating Lesions.	I. Inflammations.... II. Inflammations.... (Bacterial origin)	1. Painless Type..	Perforation of drum; inordinately profuse and prolonged purulent discharge. Sinking of post-superior canal wall or narrowing of canal's lumen (in children). Glands at angle of jaw.	Pus in tympanic cavity and mastoid process intercellular bone destroyed.	Profuse, prolonged, purulent discharge. No pain on pressure.	Sinus thrombosis; acute labyrinthitis, meningitis:—or chronic otitis media purulenta.
			Perforation, purulent discharge. Sinking of post-superior canal wall, or narrowed canal lumen. (Classical signs of mastoiditis.)	Pus in tympanum and mastoid process. Periosteum swollen, inflamed. Cortex perforated, or inner table perforated. Digastric groove seat of perforation. (Epidural or perisinus abscess.)	Pain on pressure. Swelling over mastoid region and other classical signs of mastoiditis.	Epidural, perisinus abscess. Sinus thrombosis; acute purulent labyrinthitis, meningitis (any type), resolution, with or without O. M. P. C.
		2. Painful Type.. (Fulminating Type) (Type with Fistula in Cortex, Bezold's Mastoiditis, etc.)				

# THE CLASSIFICATION.

Middle and Internal Ear Diseases and Their Complicating Lesions.	Division by Causative Factor.	Types and Names of Diseases.	Classification of Subdivisions and Subtypes.	Characteristic Otoscopic Finding.	Location of Characteristic Lesion.	Characteristic Symptoms.	Complications and Termination.
	II. Inflammations..... (Bacterial origin)	3. Otitis Media Purulenta Chronica...	1. Non-Dangerous Type.....	Perforation of varying size situated centrally (non-marginally).	Chronic suppurative process in the lining mucous membrane. Thickened and diseased mucous membrane of eustachian tube.	Deafness, discharge; mucopurulent; fetor occasionally present in children.	Acute exacerbation, more properly, an attack of acute mastoiditis, with or without complicating lesions
				Adhesive bands. Granulomata and polypi.	Nasopharynx principally involved. Epithelial ingrowths (pseudo-cholesteatoma).		
				Ossicles sparingly involved.			
			2. Dangerous Type.....	Perforation of varying size, situated marginally, involving annulus tympanicus; adhesive bands; polypi.	Bone necrosis, caries, eburnization. Ostitis ossificans; petrosal pyramidal involvement. Bone lesions of tuberculosis or syphilis; osteomyelitis of temporal bone.	Deafness, fetid otorrhea.	Acute mastoiditis, meningitis, labyrinthitis. Brain abscesses, etc.
					Ossicles involved; true cholesteatoma.	History of exanthemata.  Dizziness (late).	



# THE CLASSIFICATION.

Division by Causative Factor.	Types and Names of Diseases.	Classification of Subdivisions and Subtypes.	Characteristic Otoscopic Finding.	Location of Characteristic Lesion.	Characteristic Symptoms.	Complication and Termination.
Middle and Internal Ear Diseases and Their Complicating Lesions.	Otosclerosis...	.....	Thickened or normal appearing drum. Deposits.	Spongification of labyrinthine capsule, otitis rarificans. Ankylosis of stapes at foot plate.	Characteristic fork tests. Deafness, tinnitus, dizziness.	
	Neuritis Acoustica...	1. Acute Acoustic Neuritis.... 2. Chronic Acoustic Neuritis.	Normal appearing drum.	Hemorrhage in labyrinth. Inflammation of perineurons or atrophy of nerve (auditory).	Deafness, tinnitus, dizziness. Poisoning from: Mineral poisons, drugs. Toxins. Occupation neuroses etc.	Neuritis of other nerv

## THE CLASSIFICATION.

*Preliminary Observations Upon Pathologic Factors.*—The subdivision of this classification into types of diseases is based upon an examination of numerous pathologic specimens, and upon a study of operative finding in lieu of autopsy examinations.

In cases of what were clinically simple attacks of purulent otitis media, an idea of the extent of the involvement was obtained through the use of radiograms to substantiate the findings of other observers.

Finally, many published case histories, which contained records of exact clinical and operative data, controlled by autopsy reports, were studied. The deductions drawn were made the basis of the subdivision into types to give a working classification.

It is conceded that many points regarding the pathology are still obscure, and for obvious reasons, therefore, these are insufficient to warrant final report. As future results justify it, detailed observations will be published either to substantiate or correct inaccuracies in the system of classification herewith submitted.

## TYPES OF OTITIS MEDIA PURULENTA ACUTA.

The first type of this disease affects the new-born. The middle ear spaces contain, besides many embryonal structures subject to retrogressional changes and degeneration, amniotic fluid, which, acting as a foreign body, causes irritation, until infection supervening, a true inflammation results. It is limited to the first week of life. (Gompery, Aschoff.)

The other two types of otitis media purulenta are usually not differentiated one from the other. Yet a critical study of our clinical material will, I believe, justify this division.

We all have seen the two types. The one involving the mucous membrane alone, will usually present a perforation non-marginally situated, and located in the membrana tensa. Often the infection follows a "cold" or a previous catarrhal process in the affected ear. The middle ear and also the mastoid cells are filled with pus or mucopus (Poltzner and Bezold), but the intercellular bony walls of the mastoid process are not destroyed.

Finally, such cases do not seem, from a study of their course,

to possess the elements tending toward chronicity and also the development of what we understand clinically as mastoiditis seems a less frequent sequel than in the next type to be discussed.

Boenninghaus tries to consider these cases as an empyema of the middle ear spaces, in the same sense as the collection of pus in the maxillary antrum, where the bony walls of the antrum are not diseased, is considered an empyema of the maxillary antrum.

Finally, this class of case in its milder form, is a borderline condition between the acute catarrhal processes and the acute otitic inflammations with bone lesions. This latter condition is the true acute otitis media purulenta. The disease often follows the exanthemata and influenza, and possesses many elements of chronicity from its very origin. The perforation may be seen in either the membrana flaccida or the membrana tensa, but when situated in the former, it makes the diagnosis of bone destruction in the aditus more probable. Finally, the perforation is generally marginal.

In conclusion, according to Politzer, Bezold, and others, substantiated by my work with radiograms, the mastoid process contains pus in both these types of cases, and one finds it hard to define where the otitis media ends and the mastoiditis begins.

This is especially true of the nonpainful type of mastoiditis, which is in this classification a borderline case between the clinically recognizable otitis medias and the classical mastoiditis.

The painless type of mastoiditis has received recognition from the studies into its pathology by Boenninghaus. Its characteristic symptom is the inordinately profuse discharge which gradually increases in amount as days pass.

I have seen such cases, where the pus simply flowed from the conchal opening, and because of absence of pain and constitutional symptom, I was loth to operate, yet the operative finding in the given case showed a great amount of bone tissue destroyed within the mastoid cortex, and, studied from the operating table, the decision to operate was amply justified. I have seen these cases among both children and adults, and while I cannot give more exact data to help in their diagnosis, at this writing, except the prolonged and profuse purulent discharge, which seems to increase in amount as the disease

runs its course, I believe the condition recognizable from this sign alone, and thus place it in the classification as a distinct type of acute mastoiditis.

The condition is often overlooked as a mastoiditis, until the cortex or inner table are perforated, and the symptoms from these sequelæ call attention to the disease.

The second type of mastoiditis in the classification embraces all the classical forms which are commonly recognized and grouped as acute mastoiditis.

Chronic otitis media purulenta, or chronic mastoiditis, is a general clinical term, grouped under which are numerous pathologic lesions having one symptom in common, namely, a purulent otorrhea. I have separated the cases presenting this finding into two types of diseases—those which in their course threaten intracranial complications, and those which run indefinite courses without the advent of such sequelæ. The one type I designate as "dangerous type," the other as "non-dangerous." I confess the division to be entirely arbitrary, but, once made, a study of both series of cases presented many interesting features. For example, the cases which upon the operating table demonstrated bone lesions were found to have almost invariably been the ones whose otoscopic examination gave a perforation or defect in the drumhead, which was situated marginally.

Again, when I studied my cases upon which I performed the radical mastoid operation, the successful results almost invariably were in those whose otoscopic picture gave the same general finding—a marginally situated perforation.

In studying cases which developed intracranial lesions, it is found that the majority of such occurred in cases with this otoscopic picture, and finally the literature of intracranial cases which makes full report of operative findings and clinical data, where mention is made at all of the kind and site of the perforation, gives a larger percentage of cases with marginally situated perforations. The conclusion I fain would draw from these premises is that the marginal perforation, in chronic otitis media purulenta, is pathognomonic of bone lesion, and from cases of this disease with bone lesions, caries, necrosis, etc., the results of the radical operation are in proportion to the thoroughness with which the lesion is removable surgically.

On the other hand, the cases whose otorrhea has gone on



uninterruptedly or intermittently for years without change or inconvenience to the patient, generally were found among those whose otoscopic picture gave a centrally located or nonmarginal perforation.

The failures in my radical mastoid surgery were likewise found among this group of cases; and in the majority of these cases with nonmarginal perforations the operative findings did not show marked bone lesions, but did show, as far as it was macroscopically demonstrable, changes in the mucous membrane and also showed distinct pathologic conditions in the rhinopharynx, and finally after operation, the secretions persisting, could often be traced to the tympanic orifice of the eustachian tube.

From these premises I conclude that the nonmarginal perforation is significant of a lesion in the pharynx or eustachian tube, and in the continuation of the mucous membrane lining of the middle ear cavities.

That nonmarginal perforation should signify the nondangerous and marginal ones, dangerous types of otitis media purulenta chronica, follows from the above, and is substantiated by observations of the clinical courses of both types of cases.

It is to be noted, however, that the imposition of an attack of acute mastoiditis upon the lesions presented in the nondangerous type of chronic otitis media purulenta may bring in the train of this secondary process—the mastoiditis—any complication which logically could follow as a sequel of acute mastoiditis.

It may be interesting to state that to many of these features of both these types of otitis media purulenta chronica, I have already called attention, having presented these findings to the American Laryngological, Rhinological and Otological Society in 1908 in a discussion upon Radical Mastoid Surgery, and then suggested, when discussing Dr. McKernon's paper, that the division into these two types would perhaps enable us to prognosticate the results of the radical mastoid operation with greater surety.

I again recalled these data before this section in a discussion of Dr. Barnhill's paper on the reasons for failures after the radical mastoid operation, and finally in the last edition of Dr. Ballenger's text book there is a review of the opinions of Leutert, Zaufal and others on the significance of the marginal

and nonmarginal perforation and the location of the perforation. The conclusions arrived at by Ballenger are not entirely similar to my observations, although he concludes his statement by expressing his opinion that a radical operation "upon a case with a perforation at this point (nonmarginal perforation over the tubotympanic orifice) would, in all probability, fail to check the otorrhea." (The parenthesis is mine.)

Concluding, attention is called to the classification, which, through the courtesy of Drs. Rae and Page, I was enabled to place in your hands some days ago.

This was done to evoke a full and free discussion of its merits and shortcomings, so that through the benefit of the discussion I might improve in this work which I have undertaken.

616 Madison Avenue.

## XXI.

### OBSTINATE STENOSIS OF THE LARYNX FOLLOWING DIPHTHERIA. REPORTS OF TWO CASES.

BY D. J. GIBB WISHART, M. D.,

TORONTO.

Every laryngologist connected with a hospital for sick children will sooner or later come in contact with cases of this variety, but the two which I am about to relate present some unusual features, and are therefore of interest. The cases are as follows:

CASE 1.—F. S., female, aged 8 years. Contracted laryngeal diphtheria and entered Isolation Hospital on November 17th, 1907. Was intubated next day, and the tube removed on the 23d, again intubated on the 26th, and tube removed on December 2d, discharged cured December 24th. On January 27th the child contracted a cold, which was attended with marked dyspnea, and the laryngologist attached to the home of which she was an inmate, inserted an intubation tube, which was left in place for four days. The child entered my service in the Hospital for Sick Children on the 6th of February, 1908, and on admission the following conditions were present: Face cyanosed, breathing stertorous, pupils dilated, position of body that of opisthotonos, marked tracheal tugging, with epigastic indrawing, all the accessory muscles of respiration in energetic action, reflexes either sluggish or absent, tonsils and adenoids enlarged.

An ineffectual attempt was immediately made to introduce intubation tubes, sizes for two and four years being used, but as the patient became increasingly cyanosed, a little anesthetic was administered, the isthmus of the thyroid cut between artery forceps, and the trachea rapidly opened. As soon as respiration had been re-established, and the toilet of the wound attended to, the larynx was examined both from above and below, and the vocal chords were found to lie in close apposition, suggesting paralysis of the abductors. Forceps were

introduced from below and the chords separated, and an intubation tube, size eight years, introduced from below, then from above, and left in place. The edges of the tracheal wound were approximated with sutures, but no attempt was made to close the wound superficially, and the patient was placed in a tent bed with steam. The neck wound healed quickly, and the patient made very satisfactory progress until the twenty-sixth day, when the intubation tube was withdrawn, but within a few hours severe dyspnea again developed, and the tube was reinserted. This was coughed out a few hours after, but as the breathing continued easy, under the administration of an antispasmodic and a steam tent, it was left out. During the next fifteen days there was dyspnea, increased during sleep, but not sufficient to cause alarm. On March 18th (the 123d day) a croupy cough developed and violent dyspnea ensued, intubation was attempted unsuccessfully, and unconsciousness supervening, the trachea was again opened, with immediate relief. On the fourteenth day thereafter the tonsils and adenoids were removed, and this was followed by severe hemorrhage, but the patient progressed favorably during the month of April, and on the 5th of May (171st day) another attempt was made to intubate, three sizes of the tube being tried, but on account of spasm, insertion was impossible, and the tracheal tube was left in place. On the 21st an observation of the chords was obtained with the laryngoscope, and, as movements both of abduction and adduction were present, the nurse was instructed to plug the tracheotomy tube regularly, and the patient encouraged to use the larynx. On the 23d of June the condition of the larynx was verified by direct laryngoscopy (Killian), and the tracheal tube removed, but shortly an intubation tube was necessitated by the dyspnea, and although removed several times, it could not be finally left out until the 14th of July (231st day). On the 6th of August examination showed that the movement of the right vocal chord was distinctly weaker than that of the left. The power of phonation was good, but the voice was husky and the pitch could not be raised. General health good. Patient discharged on the 254th day.

During the whole treatment strychnin was administered regularly in doses varying up to the point of toleration, and other tonics as well.



The patient did not appear again for about three months, during which interval her respirations were notably labored and the voice hoarse. On examination both chords were deficient in abductive power, and in deep inspiration almost assumed the cadaveric position. Strychnin was again ordered and the patient allowed to accompany her mother to England, where she was instructed to place herself under observation.

CASE 2.—E. C., aged 2½ years, female. The family attendant was not summoned until the child, a delicate youngster, had suffered from what was supposed to be croup, for over ten days, but from the marked laryngeal stenosis present, administered antitoxin immediately, although there were no pharyngeal symptoms. The stenosis increased, and I was called in, October 21st, 1908, in consultation within twenty-four hours, and at once intubated. Following the custom now taught in Vienna, I had the nurse withdraw the tube at the end of twenty-four hours, but was compelled to reinsert it six hours later. The child was now showing symptoms of bronchitis, to which it had been previously subject. This tube was left in place for three days, and again removed, but within six hours the dyspnea necessitated reinsertion. On each occasion when the tube was withdrawn the tracheal tugging was as marked as at first, but when the tube was worn there was no evidence of discomfort, and the temperature, pulse and respiration gradually quieted to normal. At the end of the third day thereafter (18th day of disease), the child having been perfectly comfortable all that time, the nurse pulled out the tube, but dyspnea at once became marked. I was immediately summoned, but as the patient lived at some considerable distance, it was two hours before I reached her, and by this time cyanosis was quite evident. The tube was inserted, but the patient stopped breathing immediately, and did not recommence on its withdrawal. Tracheotomy was hastily performed, the intubation retractor being inserted through the larynx into the trachea as a guide, and artificial respiration was ultimately successful in restoring animation, and although the temperature became elevated, the patient continued to improve. Swabs from the larynx had revealed the presence of Klebs-Loeffler bacilli. On the 41st day, after swabs had been declared free of germs, on account of respiratory difficulties, an examination was decided upon, under an anesthetic. On closing the

tracheotomy wound, dyspnea at once became manifest, and was not improved by the removal of a few granulations which were found on the tracheal wall. I decided to reintroduce an intubation tube, and allow the tracheal wound to close, as the patient was much stronger and had been declared free of diphtheria by the health department. The child was allowed out, convalescence progressed favorably, and on the 53d day the intubation tube was finally removed. Although the patient at first breathed fairly well, dyspnea gradually set in, and on the 55th day she entered hospital for an examination by direct laryngoscopy, when the rima glottidis was found extremely narrow, and the bands and vocal chords covered with a patchy white membrane. The trachea was then reopened and examined with the bronchoscope in both directions, but was found absolutely clear, while the appearances of the lower surfaces of the vocal chords was the same as when looked at from above. A portion of the membrane removed at the time of operation was found charged with Klebs-Loeffler bacilli. Antitoxin was again administered, and the child continued to progress most satisfactorily as to general health and conditions, but dyspnea was speedily produced by every attempt to plug the tracheotomy wound. A week ago (125th day), after swabs taken from the trachea had been again declared free of bacilli, I examined the child, but found that removal of the tracheotomy tube was impossible because of the laryngeal stenosis, and am since informed that bacilli were found on a swab which I took from the larynx at the time of the examination, so that diphtheria is still present, but it would appear that it must be of a very mild type, as thorough isolation has been impossible, and members of the family have come into contact with the child without apparent danger.

The conduct of this case has been rendered exceedingly difficult by the age and intractability of the child, and also by its intolerance to anesthesia, which have rendered examinations of, or applications to the larynx practically impossible.

In case No. 1, the cause of stenosis was undoubtedly due to weakness of the abductors, which resisted all the usual treatments for laryngeal paralysis, and the ultimate prognosis is, in my opinion, poor, on account of the long period during which the paralysis has been noted. In Case No. 2 I have not been able to satisfy myself that paralysis is present, but

have only been able to obtain a view of the chords on one occasion, namely, when I had it in hospital. At that time the swelling of the parts and the presence of membrane would sufficiently explain the narrowing of the glottis. Now I am at a loss how to secure the healing of the larynx, and until the diphtheria disappears the further treatment to be adopted cannot be outlined. Laryngotomy might offer relief, but even Sargnon and Barlatier, as reported in the *Journal of Laryngology*, give six months as the shortest possible time required to effect a cure, and the road to be traveled presents great difficulties.

During the month following the above notes of Case No. 2 I applied nitrate of silver directly to the larynx, and treated a few granulations that appeared in the trachea, and attempted unsuccessfully on various occasions to substitute a shortened form of tube in the tracheal opening, but it was not till May 25th (227th day) that I succeeded in replacing the tracheotomy canula by a Killian perforated hard rubber plug reaching just to the outer tracheal wall. This was retained for some time, and meanwhile the attending physician, Dr. Ida Lynd, injected fibrolysin at regular intervals. The child passed through the summer uneventfully, except that tracheal tugging was still perceptible, and the onset of any slight cold caused difficulty of breathing. Early in September the difficulty of breathing became more marked, and on the 15th I examined the larynx by direct laryngoscopy under an anesthetic. The larynx was found markedly stenosed, and my smallest Killian tube would not penetrate. I then attempted to insert the smallest intubation tube, and after some effort passed it between the cords, and left it in place for some minutes, and then inserted the tube corresponding to her age, but with a decided difficulty. The child left my office breathing fairly comfortably, and continued to do so for fourteen hours, when some stenosis and great depression set in. I was not notified for two hours, and when I reached the child it was obvious that reopening the trachea was the only procedure likely to be of benefit. The heart was evidently quite unequal to its task, the patient being pallid, but not cyanosed. The father refused any operative interference, and the child quickly succumbed. Here ended a struggle protracted over eleven months, when victory was in sight.

47 Grosvenor Street.



## XXII.

### LABORATORY METHODS AS AIDS IN DIAGNOSIS OF NOSE, THROAT AND EAR AFFECTIONS.\*

BY JOSEPH C. BECK, M. D.,

CHICAGO.

The laboratory is growing in influence in the diagnoses and treatment of disease in practically the entire domain of medicine. Our department has not been entirely lacking in this respect. Nevertheless, it must be admitted that the great mass of specialists have not given this valuable aid the attention that it deserves. It is for this reason that I bring this subject before you in order to stimulate those who can see with me the importance of laboratory methods; and to show how everyone may take advantage of a practical working system in order to obtain better results. All men who have been graduated from college since the laboratories were made an important part of the teaching curriculum may become qualified laboratorians, and all that is required is sufficient interest and time. The technic, while important to understand, need not necessarily be carried out by the clinician himself. In fact, it is almost imperative that he have the technician with whom he co-operates in what is known as "team-work." This team-work is of benefit to the clinician, technician and the patient as well, and I can state without question that this method is far more satisfactory than where the clinician does the entire work himself. It has been customary for one to take a specimen of tissue, blood, etc., to refer it to the laboratory and to receive a written report of the technician's or pathologist's findings. Of course, there is considerable information to be gained from such a report, but the confirmation by one's own examination of the slide, culture, etc., gives so much additional assurance and in-

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terest that it makes the work more satisfactory to everyone concerned.

I divide my laboratory work into seven departments, as,

1. Hematologic and serologic.
2. Bacteriologic.
3. Pathologic.
4. Chemical and analytic.
5. Radiologic.
6. Photographic and illustrative.
7. Experimental.

I shall attempt to demonstrate from some of them certain results, not desiring to discuss the various subjects presented, since they serve only as examples. This material is, however, out of my own practice.

### 1. Hematologic and Serologic.

- (a) Blood counts in septic sinus thromboses as to leukocytosis.
- (b) Blood cultures in the same condition.
- (c) Cerebrospinal fluid examination in meningitis.
- (d) Coagulation test in bleeders.
- (e) Hemoglobin test in anemia.
- (f) Blood counts as to red cells in anemia.
- (g) Wassermann's and Nogouchi tests in syphilis.
- (h) Blood of a malaria (Lavaran's) organism.

### 2. Bacteriologic.

Cultures and Smears of,

- (a) *Staphylococcus albus*, *aureus* and *citreus*.
- (b) *Streptococcus*.
- (c) *Pneumococcus*.
- (d) *Bacillus influenzae*.
- (e) *Bacillus diphtheriae*.
- (f) *Bacillus pyocyaneus*.
- (g) *Bacillus typhosus*.
- (h) *Bacillus tuberculosis*.
- (i) *Bacillus rhinoscleroma*.
- (j) Ray fungus of actinomycosis (smears only).
- (k) *Spirocheta pallida* (Dunkel Kamener).

### 3. Opsonic Index Determination.

## 4. Pathologic.

## (a) Gross specimens.

Tonsils and adenoids of children (two varieties).

Tonsils of adults (two varieties).

(1) Middle turbinated body; (2) with nasal polypi, and  
(3) ethmoid curettements.

Inferior turbinated (two varieties).

Septum (three varieties).

Larynx, tubercular, syphilitic, carcinomatous.

• Goitre (three varieties).

Glands of neck, tubercular.

Ossicles of ear (removed during radical operation).

Mastoid chips.

Cholesteatoma masses.

## (b) Microscopic specimens:

Tonsils (two varieties).

Adenoids (two varieties).

Middle turbinated body (two varieties).

Nasal polypi (three varieties).

Ethmoid cell (one variety).

Inferior turbinate (two varieties).

Septum (two varieties).

Neoplasm of tonsils: Sarcoma, carcinoma, endothelioma.

Carcinoma of larynx, epithelioma of the external ear.

## (c) Microscopic specimens.

Goitre (two varieties).

Glands of neck (two varieties).

Ossicles (two varieties).

Mastoid chips (six varieties).

Cholesteatoma.

New-formed epithelium after radical mastoid operation.

Keloid scar treated with fibrolysin injection.

## 5. Chemic and Analytic.

(a) Secretion: Saliva, tears, cerebrospinal fluid, gastric.

(b) Excretions: Urine, feces.

(c) Discharges: Pus and mucus from nose, throat and ear,  
or externally about the mastoid, face and neck.

## 6. Radiologic.

An atlas containing descriptive matter as to the technic of radiography and interpretation of twenty-six typical pictures of nasal accessory sinuses of the nose and mastoid region; special attention is paid to the stereoscopic radiography and is further illustrated by a number of stereos. The purpose of this atlas is to enable any oto-rhino-laryngologist to have a radiologist take a picture of the sinuses or mastoid correctly, and be able to interpret the plate in connection with his other clinical manifestations himself. The interpreters accompanying each plate are of the utmost value to the one not accustomed to the interpretation of radiograms, and this idea has been adopted from Killian's Atlas of the Accessory Sinuses.

## 7. Photographic and Illustrative.

Stereoscopic photographs of cases.

- (a) Electric burn (live wire) of alæ of nose and face.
- (b) Tubercular osteoperiostitis of zygoma and external auditory canal.
- (c) Carcinoma of superior maxilla, postoperative.
- (d) Congenital lap ear (yellow kid).
- (e) Luetic destruction of nose (external deformity).

Stereoscopic colored photograph (Lumiere's process) of cases.

- (a) Congenital lues (external nasal deformity).
- (b) Lupus vulgaris (external portion of nose and cheeks).
- (c) Head dissection (injected with colors).
- (d) Neck dissection (injected with colors).
- (e) Dissected tonsils.
- (f) Septum nasi.
- (g) Tonsil tubercular.
- (h) Nasal polypi.
- (i) Middle and inferior turbinated bodies.

Illustrations in pen and ink, wash, oil of macro- and microscopic specimens, operations, etc.

This photographic and illustrative department of the laboratory is one of the most instructive and interesting parts. In keeping a record of cases it completes the same to a nicety. In having an artist in the laboratory it facilitates matters a great deal.

### 8. Experimental.

In connection with every well-equipped laboratory there must be some animals for experiments. Outside of the general laboratory is a place where a number of cages are situated with guinea pigs. These require good attention in order to exclude possible error when inoculating them.

I am satisfied that I have presented nothing new, but am sure that the time given to the consideration of a practical solution of the problem of laboratory work will not be amiss. Most laryngologists and otologists are connected with institutions that have laboratory facilities with good technicians, so that they can study their specimens, etc., in a very satisfactory manner. The preservation of pathologic structures removed from the nose, throat and ear, of which material there is so much, makes an excellent museum, and serves as good teaching material in the pathology of our specialty. It is about time that the waste jar should be deprived of this rich material. If one has not the hospital laboratory facilities, then one can with very little expense have his own private laboratory in connection with his office or operating room.

I know a number of men in other branches of medicine who employ a young girl to carry out the technic of the most important branches of the laboratory, as bacteriology, pathology and analyses, with satisfaction, and if one has an assistant, this is of easy execution.

In conclusion, I wish to express my regrets that the medical profession of this country is denied one of the most important parts of laboratory work, namely, postmortem examinations. Our foreign brethren, to whom this obstacle is unknown, have the tremendous advantage over us in the study of the pathology, and I hope the day is not far distant when we may be able to post our cases, at least in the large cities, in the public hospitals. These postmortems, that are made in our hospitals, are performed by the general pathologist, who, as a rule, is not competent to make a satisfactory examination of the special organs, and consequently the results are very unsatisfactory. It seems to me that when a case is posted where the nose, throat and ear and their adnexa are the chief factors in the causation of death, there a specialist should be the one to make the autopsy, at least of the head.



## XXIII.

### ATRESIA OF THE EXTERNAL AUDITORY CANAL.

By EDGAR A. FORSYTH, M. D.,

BUFFALO.

Closure of the external canal may be congenital or acquired. It is not a common condition. In looking over the literature on otology I find very little pertaining to this subject. Some of our authors make no reference to it. Bishops says records of Illinois Charitable Eye and Ear Infirmary at Chicago show only three cases of congenital absence of meatus out of 21,000 cases. Congenital atresia is usually associated with malformation of the auricle, and in most cases with malformation of the middle and internal ear from imperfect development. This internal malformation renders surgical interference inadvisable except in the simplest form, where the closure is merely by a thin layer of skin. This is a rare condition, as atresia is almost always bony, and may be so complete that no sign of the entrance into the external meatus exists. The point of occlusion is most always situated at the junction of the cartilaginous and bony portion of the auditory canal. The acquired form is of rare occurrence and is the result of chronic suppuration of the middle ear, extensive ulceration, operations, over-use of cauterizing agents, or caries and necrosis of the external meatus, phlegmonous, periauricular inflammation extending into the auditory canal. Cases have been reported following radical mastoid. Care must be exercised not to tear the membranous auditory canal from its bony attachments in this operation, as it may cause atresia of the auditory canal.

Reports of complete acquired closure of the meatus are more rare than those of congenital absence of the meatus.

It is well known that with bilateral atresia hearing and understanding of speech can exist. Two such cases are reported.

The occlusion may be skin, cartilage, bone or a combination of these elements, and the occlusion may be partial or complete.

In cases of osseous occlusion it is never complete, as careful search will usually reveal a channel through which a fine probe can be passed.

The condition is discovered when the patient seeks relief from deafness or a chronic suppurative otitis media. They usually give history of middle ear suppuration that has ceased to discharge and followed by deafness, or ear may be discharging when they seek relief. There may be pain in or about the ear, commonly in front of the tragus, or there may be frequent attacks of earache. In some cases pus seeks an outlet through mastoid. When the atresia is due to obstruction near the external orifice there may be a shallow depression to indicate the site of meatus.

The canal appears as a pale gray or grayish-red glistening cul-de-sac. The further the atresia extends externally, the shorter appears the auditory canal. When the atresia is located at the innermost part of the osseous meatus the surface of the growth may be taken for the membrana tympani. In such cases the poorly defined margin of the growth, the absence of the short process and handle of the malleus, and the shorter distance between the deeper parts and the external auditory orifice, as compared with the other side, will establish the diagnosis. By use of the probe we can ascertain whether we are dealing with a membranous, connective-tissue or osseous growth. Information regarding the thickness of the atresia is sometimes afforded through the test for hearing. In an osseous or extensive connective tissue atresia we usually find absolute deafness or a disturbance of hearing of a high degree, often accompanied with tinnitus. In membranous atresia the hearing distance for speech may be considerable. A hearing trumpet should be used in testing the hearing, as loud speech is partly transmitted through the cranial bones. In osseous and connective tissue atresia the words spoken through the trumpet will be understood with difficulty, or not at all, but if the atresia is a thin membrane, soft, low speech can be well understood, providing the middle ear and labyrinth have not undergone any great change. In those cases in which whispered speech is heard through the hearing trumpet it is quite probable that the atresia is very thin. In such cases operation is likely to do some good. On the other hand, those cases that do not hear with the aid of the hearing trumpet are not very likely to

be improved by an operation. Operative procedure gives better results in acquired than in congenital form. No operation should be undertaken to correct maldevelopment of the canal unless the middle and the internal ear are found to be intact.

Schwartz holds that invariably where grave one-sided atresia is present a maldeveloped labyrinth also exists on the affected side, and substantiates his observations by the fact that a test fork placed on the middle or the top of the head is heard only in the normal ear. When bony atresia is demonstrated to be present, surgery should be resorted to only after proving by fork test that middle and internal ears are intact. Congenital atresia involving the bone where the functioning apparatus is involved, give poor results, and operation same as simple mastoid is performed, keeping the postauricular wound open to permit sound waves to reach the middle ear through the opening may afford relief, according to Michael Jaeger. In cases of fibrous or membranous character operation by intrameatal method is indicated. In suppurative cases best results would be obtained by doing a radical mastoid operation.

I have seen one case. On August 31, 1908, Mrs. C. L., age 30, came to the Emergency Hospital Dispensary, with history of discharge from right ear since she was teething, never had any pain, but at times discharges blood and pus profusely, some pus at all times. Speculum was not needed to examine ear, as canal was closed near external opening. It looked as if closure was complete, but a small probe could be inserted into a small slit in the lower part, near the floor. End of probe came in contact with bone as soon as introduced. Its removal was followed by pus and blood. She also had a large goitre. I saw no more of her. I tried to find her later, and, on making some inquiries, found she had been operated on for her goitre and one-half was removed. She became delirious and died in a few days.

This was a case for radical operation. It was my intention of doing one on her, but I never saw her but once. With a history of chronic suppurative otitis media of nearly thirty years' duration, and as there was no malformation of external ear, I believe this to be a case of acquired atresia due to chronic suppurative otitis media and one in which operation would have been required.

322 Franklin Street.

## XXIV.

### REMARKS ON THE X-RAY TECHNIC IN THE TREATMENT OF LARYNGEAL PAPILLOMATA IN CHILDREN.\*

BY A. L. GRAY, M. D.,

RICHMOND.

Fully appreciating the fact that for an agent to be termed a remedy it must be applied with benefit in a considerable number of cases of a certain malady, I present to you two instances in which there has been a marked change for the better following promptly upon the application of the Roentgen rays to laryngeal papillomata after other measures had failed. I leave for the future to decide whether or not we have in this a remedy for this distressing condition.

With the knowledge that the Roentgen rays properly applied manifest a destructive effect upon atypical cells, preventing their proliferation and producing a retrograde metamorphosis, I determined to apply them with the hope that some such effect might be wrought on these vegetations within the larynx.

CASE 1.—(Reported by Dr. Dunn.) On July 6, 1906, Sarah C., white, age 3 years, 2½ months, residing in a distant state, was referred to me by Dr. John Dunn, of this city. Family and personal history, excellent. Three months after birth hoarseness began. This persisted in spite of all efforts to relieve her "bad cold," until the first week in July, 1905, when her respiration became so obstructed that she was brought to this city on July 11th, and a tracheotomy was performed by Dr. Dunn one hour after her arrival. The following winter after a "cold" she again presented evidences of obstruction to her respiration, with the tracheotomy tube in situ. This con-

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\*Read by invitation at a meeting of the American Laryngological, Rhinological and Otological Society, Southern Section, Richmond, Va., February 12-13, 1909.



tinued without improvement until July, 1906, when she was again brought to this city, and received her first X-ray treatment on July 6th, of that year.

My intention was to give her daily treatments on alternate sides until she should approach the reaction, limit, but bad weather, and some intercurrent intestinal disorder prevented the strict execution of my plan.

Treatments were given with a static machine giving a half to three-fourths milliamperes in the tube circuit, with the tube backing a parallel spark gap of four to five inches (about Walter 5). The rays were directed through a lead glass protecting shield, to each lateral aspect of the neck at a point corresponding with the larynx, the child being seated in her mother's lap. Each application was of ten minutes' duration, target ten inches from the skin. She received thirteen treatments within a period of twenty-five days.

In June, 1907, she again returned, this time much improved. Nine treatments were given in nine days, alternating the sides.

On November 3, 1907, she began her third series, and received eleven treatments in nineteen days. At the expiration of this series the base of a single papilloma, that had been present when the series was begun, had disappeared entirely.

The tracheotomy tube was permanently removed by Dr. Dunn July 21, 1908.

A letter from her mother, dated January 26, 1909, reports the child as "fine, can talk as loud as anyone would have her," although the tracheotomy wound has not entirely closed.

CASE 2.—J. McL., white, male, age 6 years. Referred by Dr. John Dunn, July 30, 1908. Diagnosis, laryngeal papillomata. Tracheotomy performed two years previously by Dr. Dunn. Condition of his larynx, same as when operated on.

Treatments were begun July 30, 1908, using twenty-four inch induction coil, tube reading Walter 5, three-fourths milliamperes in tube circuit, five minutes, at fifteen inches, mercury interrupter. Applications daily, treating alternating sides. Eight exposures were given in eight days.

Improvement began after five treatments. His parents were instructed to bring him back to me in six weeks, but owing to illness in the family, he has not been returned for a second series. His father promises to have him here during the present month.

A letter from his physician, dated January 21, 1909, states that "his improvement has reached a point where he can now breathe through the pharynx fairly well with the tracheotomy tube removed and the opening closed with the finger. I doubt whether it would be safe yet to leave the tube out permanently, as there is still some obstruction to his respiration."

Owing to the distance of residence, and the obstacles presented thereby, neither of these cases was watched as carefully as desired, thus accounting for the apparent lack of definite system in the reports of these cases.

In the treatment of malignant neoplasms beyond the skin, the roentgenologist has to encounter the serious obstacle of the absorption by the skin of the rays that are so efficient in superficial cancers; hence the failure to obtain good results in the deeper growths. Marked effects, however, are produced on other cells in the deeper organs of the body. The radiations from the Crooke's tube are not homogeneous; one kind is absorbed by the skin, another penetrates. It is possible that the penetrating rays are those which exert the influence, if there is any, on the papillomatous formations.

312 E. Franklin Street.

## XXV.

### REMOVAL OF A RHINESTONE FROM THE MIDDLE EAR OF A CHILD. EXHIBITION OF SPECIMEN.\*

BY CLEMENT F. THEISEN, M. D.,

ALBANY.

Early in May, 1908, a boy five years old was brought to my office with the following history: About six weeks previously, while playing with some children, he inserted a rhinestone, which had been taken out of a cheap ring, into the left ear, and in attempting to remove it pushed it further into the canal.

The boy lives in another city and was taken to the family physician, who could see the stone, but could not get hold of it. Another physician (not a specialist) was called, the boy was given an anesthetic and, according to the father's story, for two hours attempts were made to remove the stone from the ear, but without success. This operation was followed by a profuse bloody discharge, which later became purulent, and then in about ten days stopped spontaneously. I did not see the boy for over a month after the attempts at removal, and then there had been no discharge for about two weeks, but the boy could hear very little on that side.

On examination I found that the left tympanic membrane had been practically destroyed, and all I could see was a mass of granulation tissue.

On examining with a probe I could feel a distinct resistance through this, and on tapping very gently could hear a click, showing that the foreign body was there.

The boy was sent to St. Peter's Hospital, put under ether, and the granulations carefully curetted away. This was followed by a fairly profuse hemorrhage, which could be readily controlled with adrenalin, and the rhinestone could then be plainly seen in the middle ear.

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\*Read at the meeting of the Eastern Section of the American Laryngological, Rhinological and Otological Society at Watertown, N. Y., January 15, 1910.

I tried to remove it through the meatus, but could not get back of it, and the instruments constantly slipped off.

A posterior incision was then made, part of the posterior bony canal wall removed, and then, after several attempts, a ring curette could be inserted back of the stone, and it was removed.

There was a discharge from the ear for several weeks, and later, as a result of the first attempts to remove the stone, a stricture of the external meatus developed, which had to be corrected by a secondary operation.

The boy is now in good condition. Hearing not quite as good as with the other ear, but the calibre of the external canal is nearly as large as that of the right ear.



## XXVI.

### THROMBOSIS OF THE JUGULAR BULB WITHOUT APPARENT INVOLVEMENT OF THE LAT- ERAL SINUS; UNUSUAL BLOOD COUNT; METASTASIS; PARALYSIS OF EXTERNAL RECTUS OCULI.

BY JOHN R. PAGE, M. D.,

NEW YORK.

The complications which occurred in this case of acute mastoiditis are, I think, sufficiently interesting to warrant my reporting them. She had a thrombosis of the jugular bulb without any apparent involvement of the lateral sinus, and later a paralysis of the external rectus of her right eye and a metastasis in her forearm. Her blood examination, two days after the mastoid operation, when she was in good condition except for her high temperature, showed almost a leucopenia, and not until her jugular was excised three days later did the leucocytes number over 10,000.

I regret that I was unable to obtain a blood culture when the symptoms of thrombosis first developed, and that no examination of the jugular vein was made by a pathologist after it was removed.

The patient, a young woman of 20, unusually strong, and well nourished, with no history of previous disease worth mentioning, complained of an earache of three days' duration. Examination showed in the right ear a bulging drum, small perforation, slight discharge and slight tenderness over the mastoid antrum, temperature 99. After a myringotomy, which was refused until the following day, her temperature went to 104. The next day, the fifth after the onset, the mastoid was opened and found well involved, though not in an advanced stage of suppuration. The bone was very cellular, and the inner plate thin and hard. The bone was cracked over the sinus knee and removed for nearly a half inch, disclosing a

perfectly normal looking thin-walled sinus. The operation was completed and no further trouble anticipated. That night her temperature went to 104.4 and the next night to 104.8, with a variation during the day of two degrees. The dressing was removed, and, finding no infection of the skin or wound, exploration of the sinus was considered, in spite of its normal appearance. Just at this time, however, the report of a blood examination by Dr. Zabriskie came, showing only 6500 leucocytes and 63 per cent polynuclear neutrophils. The patient presented no appearance of sepsis and her general condition was excellent, tongue and mucous membranes moist in spite of the high temperature. A careful physical examination by Dr. Wilcox revealed evidence of slight constipation only. Blood was sent for a Widal examination, and a negative report was returned. Urine showed a positive diazo reaction. Her temperature the following night was 105. The next morning, Dr. Zabriskie being away, Dr. Scruton, of the House Staff, examined her blood and reported 9700 leucocytes and 84 per cent polynuclears. The patient still had no appearance of septic poisoning, pulse was around 100 and not above 110 with the highest temperature, no chills nor chilly sensations. At midnight temperature went to 105.2, and next day, the fifth after the mastoid operation, exploration of the sinus was decided upon. A blood count on this day by Dr. Huvelle of the House Staff showed 9100 leucocytes and 81 per cent polynuclears. The sinus was uncovered from a point one inch behind the knee to the horizontal turn toward the bulb, and its external appearance, except where it had been exposed at the previous operation, was perfectly normal. It was compressed above and below, and opened with a pair of small scissors, one blade in the lumen of the vein, from above downward, almost throughout its whole exposure. A good view was obtained of its interior; no clot was discovered, and its internal walls appeared white and glistening. A free flow of blood followed relief of pressure above, but there was little or no flow from below. The jugular was then ligated in the lower part of the neck and lifted out of its bed. The glands along its sheath were somewhat enlarged in the upper part, but the walls were thin and the vein filled well. After its ligation above the facial vein, however, it failed to fill. It was removed filled with blood and put aside for examination, but through a nurse's

mistake was lost. After excision of the internal jugular a curette was passed into the lumen of the sinus toward the bulb, but no increase in the flow of blood was obtained from this direction, nor was any clot demonstrated. Her condition became considerably weakened after the jugular operation, and her appearance was decidedly septic, a severe chill occurring on the second day, followed by vacillations in temperature between 105 and 103 for three days, when it began to fall gradually.

On the second day after the operation paralysis of the external rectus of the right eye developed, and an abscess appeared in the left forearm, from which two or more drachms of pus were evacuated a few days later. Blood examination by Dr. Hoobler the day after the jugular was excised showed 18,000 leucocytes and 87 per cent polynuclears, and blood culture was negative. If the blood report with the low leucocyte count and polynuclear percentage had not been presented, the sinus would have been explored and the jugular in all probability excised on the second day after the mastoid operation instead of the fifth, but the low leucocyte count suggested beginning typhoid rather than beginning sepsis, and the exploration of the sinus was postponed, I think unjustifiably, because of it. In the case of sinus thrombosis with typhoid symptoms that Dr. Phillips reported, the blood count seemed to be of diagnostic value; in this case it was decidedly misleading.

The paralysis of the external rectus muscle is interesting when the relation of the sixth nerve to the inferior petrosal and cavernous sinuses is considered. This paralysis was almost complete at first, but is now hardly evident. It is remarkable that the nerves that pass through the jugular foramen in such close relation to the vein are rarely if ever affected in these cases. I was reminded of this close relation in another case, when after having excised the jugular, I passed a bent curette down into the bulb and several times got a marked jerk of the shoulder from irritation of the spinal accessory nerve. There was no evidence of any irritation of the vagus.

## XXVII.

### THROMBOSIS OF THE LATERAL SINUS; WHEN TO OPERATE; WHAT TYPE OF OPERATION TO CHOOSE.

By E. A. CROCKETT, M. D.,

BOSTON.

This paper has to deal with a subject which has been discussed more or less elaborately at many medical meetings, and certainly there have been enough individual case reports to bring the symptomatology well before all practitioners of otology, but this paper may be timely in that there is a wide difference of opinion as to when we should operate, after we are aware that there is a thrombosis of the lateral sinus and perhaps other sinuses or the jugular, and there is a particularly wide variation as to the nature of the operation which we should do. With a view to this latter question, I have gone over all the cases of operation upon the lateral sinus at the Massachusetts Charitable Eye and Ear Infirmary since 1905, that is, for the past five years. The statistics are drawn from the case histories of sixty operations by six different operators, and it is interesting at the onset to observe that there is apparently no difference of opinion among the surgeons and assistant surgeons at the hospital, either as to the type of operation which should be performed or the time at which it should be done. As you will see, all of our men are apparently agreed that as soon as the diagnosis is made the operation should be performed, and, personally, I think it is far better to do an early unnecessary operation than to allow the case to go too long and come to a fatal result, which could probably have been avoided by an early operation.

As far as possible, therefore, it would seem that all of these cases were operated upon in the early stage of the disease, some even before the thrombus was organized, but where the clinical signs pointed unmistakably to the formation of a parietal clot. Perhaps it is well for me to emphasize now these



symptoms, and in so doing I must, of course, mostly speak of the symptoms which influence me to operate, as I cannot speak for my colleagues in this respect. I should suspect the formation of a thrombosis in the lateral sinus in all cases of ear disease where there is a rapid elevation, with equally rapid remission of temperature, without the presence of cerebral symptoms. This rapid elevation and remission of temperature is to my mind of very great importance, and unless a three or four hour chart is kept it will be oftentimes impossible to detect its existence. With this elevation of temperature in adults there will usually be chilly sensations or actual chills at the period of elevation, and these may be as often as two or three times in the course of twenty-four hours. This, to my mind, is the most frequent and most diagnostic single symptom, and I have seen only two cases where a lateral sinus thrombosis has existed without such elevation of temperature. As accessory symptoms great stress should be laid upon increased leucocytosis and especially on a high white count with a high polymorphonuclear percentage.

In my service at the Massachusetts Charitable Eye and Ear Infirmary for a number of years it has been the custom to take a white count as a routine procedure as soon as the patient enters the hospital. If in such cases, coincident with elevation of temperature, the white count is found to rise steadily it is a far more certain evidence of sinus disease than a single count showing a high percentage. As far as my experience goes, although not an expert on blood counting, a very high white count is not usually obtained in otitic septi-cemia, and in the majority of cases here reported the count has not been over twenty thousand whites. This of itself is of some importance in considering the question of differentiation of meningitis, in which the count is usually thirty, forty or fifty thousand whites. Again, in my experience, an optic neuritis, either unilateral or bilateral, is a not uncommon early symptom in lateral sinus thrombosis, and is comparatively uncommon in acute cerebral infections in very early stages. In these sixty cases optic neuritis was observed in fifteen. Optic neuritis has also been observed in this disease by Kipp, Jansen, Lermoyez and Gruening.

Of course the diagnosis becomes easy when typical symptoms exist in cases where a mastoid operation has previously

been performed and where at this operation the sinus has been opened accidentally, or there has been found a perisinus abscess. Here, of course, the route of infection is at once evident. In regard to the first accident, namely, accidental opening of the sinus during operation, in nearly all of the cases I have observed for the last twenty years, a purulent thrombosis of the sinus has resulted, necessitating operation. I therefore regard this as much more serious than it is commonly supposed to be.

The observation of all my own cases where the lateral sinus has been accidentally opened prior to the time when we performed ligation of the jugular is interesting as showing the great diminution in the mortality resulting from stopping the natural drainage canal of the jugular vein. Prior to the operation of ligation, I remember four deaths in my own cases from general septicemia following accidental opening of the vessel, and since ligation, while I have seen a number of undoubted operative infections, all have speedily recovered after early ligation of the jugular.

It is also an interesting fact that the majority of the cases reported to-night were secondary to acute infection of the middle ear. This, I am sure, is quite contrary to my experience in the first ten years of practice where, although I have not the exact statistics, the vast majority of cases were secondary to chronic suppuration of the middle ear. There are two reasons for this: First, the infections of the middle ear and mastoid latterly are far more severe than formerly, and second, we do not see in the clinic as many cases of neglected chronic middle ear suppurations as fifteen years ago, owing to the fact that the general public and general practitioner are both aware of the importance of treating otitic suppuration.

Now, taking the cases I have reported to-night, I put myself emphatically on record in saying that we should operate with a view of relieving the thrombus in all cases of acute or chronic otitic suppuration presenting rapid elevation and remission of temperature for more than three days, especially with chilly sensations or chills, headache, vomiting, general malaise and increasing leucocytosis, without waiting for the undoubted symptoms of otitic septicemia, characterizing the latter stage of thrombosis with formation of metastases. I would make this advice particularly emphatic in cases where a former

operation has resulted in an accidental opening of the sinus or revealed the existence of a perisinus abscess, and subsequently such symptoms are exhibited.

Having decided to operate, then comes the question of what type of operation we should perform. Here there is a large difference of opinion revealed in the monographs of the various surgeons who have reported such operations in the last ten years.

We may confine ourselves to relieving the original source of the trouble in the middle ear or mastoid, making only an exploratory opening in the sinus, and if in such a case thrombus is found, removing the soft portion of such thrombus only. This is the oldest type of operation, and I suspect the most frequent at the present day.

Second, after performing the regular mastoid operation we may explore the lateral sinus and, having found a thrombus, then tie the internal jugular as low as possible and resect all the thrombosed portion of the vein, which in many cases may extend from the lower portion of the neck to the jugular bulb.

Third, we may in addition to the mastoid portion of the operation, tie off the internal jugular below the point of thrombosis and bring the upper portion of the vein out of the neck wound and use it as a natural drainage tube. It may in certain cases be flushed out, where a softened purulent thrombus exists.

Fourth, we may simply ligate the jugular without resection or without bringing the upper end out of the neck wound, which is, of course, the simplest and shortest operation and the one, in my experience, most successful in a large variety of cases.

If we follow the last operative procedure, shall we open the sinus above, before ligating the jugular, or shall we ligate first and open above last?

I shall at once dismiss the first operative procedure, namely, simply opening the lateral sinus and removing as much of the thrombus as possible, as an unsurgical procedure. In doing this I am, of course, really consulting only my own surgical predilections. This was the operation performed by all of us in the beginning, and the best I can say about it is that it is more satisfactory than not opening the sinus at all. It reduced the mortality rate ten and fifteen per cent in a large



series of statistics, but it should be remembered that about fifty per cent of the cases of lateral sinus thrombosis recovered eventually without operation. It shortens the duration of the septicemia considerably—still the patient is sick a long time. It does not relieve the danger of metastasis, which is certainly the point of greatest danger in this disease, and, in fact, an extensive curetting of the thrombus may actually cause a metastasis where one has not existed before. I have seen this occur two or three times.

Second, should we resect the whole thrombosed portion of the vein? This operative procedure I have never performed myself, and I think it has only been performed once at the Massachusetts Eye and Ear Infirmary, at least I found only one record of this operation in carefully searching the records for the past six years. It is undoubtedly a proper surgical procedure, except that it is too radical. It is a long and difficult operation, leaves the patient with a large scar on the neck, requires a great deal of surgical experience on the part of the operator and, in my opinion, subjects the patient to an unnecessary amount of surgical shock.

This expression of opinion will doubtless create an argument at this meeting, as I intend it to. All I can say is that by the simple procedure followed at the Massachusetts Charitable Eye and Ear Infirmary the death rate seems to me very materially lower than that following any other operative procedure I have seen reported, which fact, if true, certainly justifies the simple operation.

Whether the jugular should be simply ligated and the ligated end allowed to drop back into the wound or the ligated upper end brought out is the next point at issue. For several years I brought the end out and used it for a drainage tube, the method now used by Alexander and by Politzer's clinic generally. At the present time I allow the operated end to drop back into the wound and put a gauze drain down through the deep cervical fascia, allowing the vein to rupture spontaneously above the ligature, and discharge from the neck. Such discharge, as a rule, lasts only three days to a week, and is accompanied by only a slight disturbance and does not affect the ultimate healing of the wound. By either of these methods a very simple scar is made, so small as to be hardly noticeable in two or three years after the operation. I have a number of



times had difficulty in finding it in operated cases where the original incision had been made with some consideration of the ultimate cosmetic effect.

This operation of simply ligating below the lower end of the thrombus or, in any event, through the firm portion of the thrombus, can be done very rapidly, with very little shock to the patient, through a very small incision, and has certainly been adopted upon by the different members of the staff at the Massachusetts Charitable Eye and Ear Infirmary. I found in searching the records over at the hospital in the last five years that this operation had been performed, without variation, in every case of lateral sinus thrombosis in the hospital, irrespective of whether the disease was of long or short duration, and whether the thrombus was purulent or otherwise, or whether metastases did or did not exist.

The death rate in these cases was 16 per cent.

These statistics, it seems to me, justify the simple operation, and, in fact, make its mortality rate far better than that of any other type of operation of which I have any knowledge, especially when you consider the fact that these are all hospital cases, none in private practice, consequently many of them patients of low resistance and where the disease has run a long course prior to operation. Many of them were in a critical condition at time of operation. Simplicity of operation is certainly a thing much to be desired, as is also rapidity.

I have had three cases, two in the hospital and one in private practice, where the patient was so desperately sick at the time of operation, that it was a question whether he would survive etherization or not, consequently rapidity of operation was of the greatest importance. In these cases I confined myself entirely to the primary ligation of the jugular at the point of election, and hastily opened the mastoid cortex, without attempting to freely curette the cells or establish a communication of the antrum, or, still more important, not attempting to uncover the lateral sinus or to ascertain the condition of the vessel. The operation in these cases did not take over fifteen minutes, and two out of the three recovered, it being of course necessary to complete the operation at a later date.

Now, having decided to do this type of operation, should we ligate the jugular before exploring the lateral sinus, or after? This seems to be the disputed point and is the only one

in which I see any difference in opinion among the surgeons in the hospital I represent. In the majority of the sixty operations I am reporting the jugular was ligated prior to opening of the sinus, and I am bound to state that there is no great difference in the mortality between those where it is ligated first and those where it is ligated last; in fact, as will appear later, most of the cases that died were particularly septic at the time of operation, and several of them died three or four hours after etherization, but on searching the cases there were no signs of metastases prior to the operation, but an immediate metastasis after the operation, to my mind undoubtedly due to the fact that, a considerable amount of exploring and probing having been done, a portion of the jugular clot was loosened. This of itself seems to me so sufficient to condemn this surgical procedure. One of these died; two recovered.

If we have decided to ligate the jugular at all, we should do so on the general symptomatology. It does us no good to expose the lateral wall of the sinus, as it is often impossible to tell from the outside of the sinus whether a thrombus exists or not. The outer wall may be hard and yellow and covered with granulation from merely an external dural thickening or from the existence of a perisinus abscess, and in such cases there may be intrasinus disease; or we may have sinus clot either parietal or central where the vessel looks normal and where a simple puncture may show free blood.

In fact, the best time to operate upon otitic septicemia is before the formation of sinus clot, in the early stage of beginning thrombosis. Having decided to operate, always ligate the jugular first. You can then explore the sinus as much as you please, without any risk to the patient, and remove what thrombus you find in the vessel without fear of possible formation of metastatic abscess, which may be far more serious to the patient than the original disease.

An analysis of these sixty cases reveals some interesting points. In the first place as to infection. The microorganism recovered from the cultures was in a large proportion of cases streptococcus. Out of thirty-five cases where the records stated that the culture had been taken, streptococcus was found in fifteen, streptococcus and pneumococcus in two, streptococcus and staphylococcus in four, "mixed infection" in four, pneumococcus in two, staphylococcus in seven, tubercle bacillus

in two, thus agreeing with the statement made by Dr. Gruening in a paper entitled "Sinus Thrombosis of Otitic Origin and Its Relation to Streptococcemia," *New York Medical Journal*, June 5, 1909.

The two cases of tubercular thrombosis were both proven by injection into a guinea pig, in addition to the ordinary examination. One recovered and one died from acute miliary tuberculosis subsequent to operation.

Two cases were subsequent to a broken-down blood clot operation causing a perisinus abscess.

One case was an acute streptococcus infection subsequent to an adenoid and tonsil operation. Four days after the adenoid and tonsil operation a mastoid operation was performed and the lateral sinus found thrombosed. The culture from the sinus showed streptococcus, and the case also developed a cerebral abscess, and a lumbar puncture showed free streptococci in the spinal fluid. The patient died eight days after the last operation.

Five cases had metastases, three of which were abscesses in the lung, two of which had a general streptococcus infection. Two out of the three recovered. The other metastases were all joint infections, mostly multiple, but none died. In the cases with metastases, therefore, the mortality was 20%. A resumé of the cases which died may not be out of place, as I desire to prove that in these cases no amount of extensive dissection of the vein would have proven more efficacious than the simple ligation that was performed. It will be noticed that in many of the patients meningeal symptoms were present, and I think a fair analysis of the symptoms will show us that in many of them basilar meningitis or cerebral abscess were present and were the probable cause of death. In fact, out of all the cases only two died from pure septicemia. In my own experience in private practice, as well as in the hospital, basilar meningitis has been the common cause of death, and is due sometimes to extension backward of the purulent process in the sinus. These cases probably have a diminished general resistance and are unable to prevent the extension of the disease process.

In some of the others an error in diagnosis was made, and such were never cases of thrombosis of the sinus at all, but were meningitis with ill-defined symptoms. This is a difficult



diagnosis at times to make, but I have included in this series all cases of operation on the sinus or jugular in order to avoid any error in the mortality statistics.

To proceed with the analysis of individual cases.

CASE 1.—A child with acute meningitis and thrombosis of the internal jugular vein. A radical operation was performed and the jugular ligated, and the case died four days after the operation.

At the postmortem there was found a basilar tubercular meningitis and general miliary tubercular infection. It is quite obvious that this case could not be saved by any type of operation.

CASE 2.—Acute suppurative middle ear with mastoid, complicated with pregnancy at term. The aural disease had existed for 21 days. The white count was 6,000 whites, 78% polynuclear cells, and the mastoid was found full of pus and freely opened. The jugular was ligated first and the lateral sinus explored afterward at a second operation.

The culture from the resected vein showed pure streptococcus. The patient died two days after the jugular operation and four days after the mastoid operation, and was only sick four days in the hospital.

CASE 3.—A child. The records state the duration of the aural disease four days, which seems to me probably a mistake. The child died thirty-two days after the operation, having had a cerebral abscess, peritonsillar abscess, sinus thrombosis, a mastoid operation and ligation of the jugular and four major operations. It apparently died of exhaustion. The culture from the vein showed streptococcus and staphylococcus, and free streptococci were found in spinal fluid.

CASE 4.—Chronic case of ear disease; one year's duration. A mastoid operation was performed first, the jugular was ligated and the lateral sinus was opened together three days later. Patient died two hours after the operation. Culture from fluid blood in the lateral sinus showed a pure culture of streptococcus. A culture from the ear discharge showed streptococcus and staphylococcus and there was also a general leptomeningitis. The patient was in the hospital five days.

CASE 5.—An adult, sick only one week with an acute ear infection, following influenza. A mastoid operation was performed only one week after the original infection, and was followed



by ligation of the jugular twenty-four hours later. A culture from the jugular showed diplococcus catarrhalis. The patient died of septicemia five days after the operation.

CASE 7.—Acute pneumococcus infection; three weeks' duration. A mastoid was first performed, at which operation a perisinus abscess was found. There were multiple metastases, and the case died three days after the operation.

CASE 8.—Acute infection; sick two weeks in the Massachusetts General Hospital, with a diagnosis of typhoid. There was an enlarged spleen, double optic neuritis and a rapid elevation of temperature to  $104^{\circ}$  and Kernig reflex. White count 17,000. A mastoid operation was performed and the lateral sinus explored before the jugular was tied. There was free bleeding from the sinus at time of operation. Thirty-six hours later a metastasis developed in the left elbow and forty-eight hours later in the lung. The case died three weeks after operation.

This is one of the cases where I think it is possible had the jugular been ligated prior to opening and curetting of sinus a fatal result might have been avoided.

CASE 9.—Chronic case. A radical mastoid operation was done and a perisinus abscess found with a purulent thrombosis of the sinus and jugular. The case died with meningeal symptoms three days after the operation.

From my own experience I have, therefore, arrived at the following conclusions:

First—Operate early, wherever possible, in the preliminary stage of formation of thrombus rather than after a thrombus is formed.

Second—The symptoms which suggest the formation of a thrombus in the order of their diagnostic importance are, wherever in the existence of a freely discharging ear, with or without a tender mastoid, the patient presents a septic temperature with or without chills, but without cerebral symptoms, continuing three days or more, with no obstruction to drainage of the middle ear as far as can be seen, an optic neuritis more frequently unilateral than bilateral or increasing leucocytosis with a high polymorphonuclear percentage. Excepting that in the case of young children all these symptoms, except the optic neuritis, may exist without thrombosis.

Third—Operate always where, in addition to some or all of these early symptoms, there are symptoms indicating a metastasis, which, judging from these sixty cases, is usually first in the lung, second in the joints and third superficial. In this class of cases we must not expect our mortality to be as slight as in the earlier operation.

Fourth—Judging from my own personal experience, as well as that derived from the sixty cases here reported, the route of general infection in the overwhelming majority of cases seems to be the natural channel afforded by the lateral sinus and its extension into the internal jugular vein. The simple ligation of the vein, if possible, below the point of thrombus seems to be equally effective in cases of softened thrombus, firm thrombus or formative thrombosis. It should always be performed as early as the diagnosis can be made with certainty, but it is not necessary to resect the vein or bring the end of the vein out of the neck as a drainage tube. It is not even necessary where time and absence of shock is a factor of importance to perform a thorough mastoid operation or to open the lateral sinus above and remove the thrombus in that portion of the vessel, although this should always be done, except under these circumstances.

## XXVIII.

# THE SERODIAGNOSIS OF SYPHILIS IN ITS RELATION TO DISEASES OF THE EAR.

BY EDMUND PRINCE FOWLER, M. D.,

NEW YORK.

The vastness of the subject manifestly makes it impossible to review within the limits of one paper of ordinary length the subject of syphilis in its relation to and occurrence with diseases of the auditory apparatus. I shall, therefore, limit my remarks to a report of the 128 cases whose blood serum I had analyzed by the complement fixation test, arranging these cases in groups, detailing important facts brought out by the examinations and calling attention to some aspects of the subject which strike me as worthy of special consideration.

The method devised by Dr. Hideyo Noguchi was used throughout, and owing to his great kindness I was fortunate enough to have all the specimens of serum examined by the originator of the method himself.

If these cases illustrated nothing from the standpoint of the otologist, they would still be of great interest as adding further proof as to the dependability of Noguchi's method.

It may be well here to briefly state in the author's own words the main differences and advantages of his own method as compared with that of Wassermann and others:

"It is important to bear in mind that the main difference between my system and the Wassermann system lies in my use of a known quantity of amboceptor, while in the Wassermann system we meet a difficulty in the fact that human serum may contain anywhere from 0 to 20 units of natural hemolysin (amboceptor) capable of inducing hemolysis of sheep's corpuscles. This introduces an uncertain factor into the interpretation of the results, inasmuch as an excess of anti-sheep amboceptor leads to hemolysis even in the presence of syphilitic antibody. Any system using foreign corpuscles, such as

that of Bauer, Hecht, Stern, and Detre, is equally apt to give fallacious results.

Minor differences often of great importance to the individual doing the test are: (1) In my system it is possible to preserve the various reagents, such as antigen, amboceptor, and, if necessary complement, in stable form, dried on filter paper and then titrated, ready for use; (2) in my system the quantity of blood necessary for the test is very small, only a few drops; inactivation is not necessary and the blood need not be fresh; (3) the ease with which certain of the reagents can be procured is a factor; in my system human corpuscles are used, and the patient's own cells can be utilized. In all the other methods it is necessary to have a fresh supply of corpuscles, sheep's, horse's, etc., always on hand; (4) all the other methods require a complete laboratory, while any laboratory worker can do my test with a very small equipment." (See *J. A. M. A.*, p. 935, Vol. LIII.)

On my suggestion, in about twelve cases serum obtained by using blistering plaster was tested, and subsequently serum obtained in the usual way from these same patients gave reactions identical with the first. In many cases, unknown to the tester, two and even three specimens were examined, and always with the same result, and in no instance was a diagnosis of the disease or a word as to its syphilitic probabilities intimated. This is, I believe, the first time that blister serum has been used for these hemolysis tests.

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**Results Obtained With Noguchi's Modification of the Wassermann  
in Diseases of the Ear.**

	Strongly Positive.	Weakly Positive.	Doubtful.	Negative.	Total Cases.
<b>Children.</b>					
O. M. S. Ac.....	1	8	3	20	32
O. M. S. C.....	5	4	2	13	24
O. M. C. C.....	0	1	0	2	3
Mastoiditis .....	1	1	1	2	5
Nerve deafness .....	0	0	0	2	2
<b>Total cases .....</b>	<b>7</b>	<b>14</b>	<b>6</b>	<b>39</b>	<b>66</b>
<b>Sex. Males .....</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>19</b>	<b>25</b>
<b>Females .....</b>	<b>5</b>	<b>13</b>	<b>3</b>	<b>20</b>	<b>41</b>
<b>Percentages in children....</b>	<b>10<math>\frac{2}{3}</math>%</b>	<b>21<math>\frac{1}{3}</math>%</b>	<b>9%</b>	<b>59%</b>	<b>100%</b>
<b>Adults.</b>					
O. M. S. Ac.....	0	1	2	7	10
O. M. S. C.....	0	1	2	10	13
O. M. C. Ac.....	0	0	0	2	2
O. M. C. C.....	5	3	3	18	29
Mastoiditis .....	0	1	0	2	3
Nerve deafness .....	3	1	1	0	5
<b>Total cases .....</b>	<b>8</b>	<b>7</b>	<b>8</b>	<b>39</b>	<b>62</b>
<b>Sex. Males .....</b>	<b>6</b>	<b>2</b>	<b>1</b>	<b>24</b>	<b>33</b>
<b>Females .....</b>	<b>2</b>	<b>5</b>	<b>7</b>	<b>15</b>	<b>29</b>
<b>Adult percentages .....</b>	<b>13%</b>	<b>11%</b>	<b>13%</b>	<b>63%</b>	<b>100%</b>
<b>Total cases in adults and children:</b>					
<b>Males .....</b>	<b>8</b>	<b>3</b>	<b>4</b>	<b>43</b>	<b>58</b>
<b>Females .....</b>	<b>7</b>	<b>18</b>	<b>10</b>	<b>35</b>	<b>70</b>
	<b>15</b>	<b>21</b>	<b>14</b>	<b>78</b>	<b>128</b>
<b>Total percentages in adults and children .....</b>	<b>11<math>\frac{3}{4}</math>%</b>	<b>16%</b>	<b>11%</b>	<b>61%</b>	<b>100%</b>
<b>Total positive percentage</b>	<b>Total negative percentage</b>				
<b>in Males .....</b>	<b>6<math>\frac{1}{4}</math>%</b>	<b>in Males.....</b>	<b>39 %</b>	<b>45%</b>	
<b>Females .....</b>	<b>5<math>\frac{1}{2}</math>%</b>	<b>Females .....</b>	<b>49<math>\frac{1}{4}</math>%</b>	<b>55%</b>	
	<b>11<math>\frac{3}{4}</math>%</b>		<b>88<math>\frac{1}{4}</math>%</b>	<b>100%</b>	

In the children hypertrophied tonsils and adenoids were present as follows:

Disease.	Strongly Positive.	Mildly Positive.	Doubtful.	Negative.	Totals.
O. M. S. Ac. ....	0 in the 1 case	6 in the 8 cases	2 in the 3 cases	14 in the 20 cases	22 in the 32 cases
O. M. S. C. ....	4 in the 5 cases	2 in the 4 cases	1 in the 2 cases	13 in the 13 cases	20 in the 24 cases
O. M. C. C. ....	0 in the 0 cases	0 in the 1 case	0 in the 0 cases	0 in the 2 cases	0 in the 3 cases
Mastoiditis .....	0 in the 1 case	0 in the 1 case	1 in the 1 case	0 in the 2 cases	1 in the 5 cases
Nerve deafness .....	0 in the 0 cases	0 in the 0 cases	0 in the 0 cases	0 in the 2 cases	0 in the 2 cases
Total present .....	4 in the 7 cases	8 in the 14 cases	4 in the 6 cases	27 in the 39 cases	43 in the 66 cases

#### IN CHILDREN:

In O. M. S. Ac. cases the ear disease was right, left or double about an equal number of times.  
 In O. M. S. C. cases the ear disease was right and left equally often and double twice as often as either.

#### IN ADULTS:

In O. M. S. Ac. cases the ear disease was right and left equally often and double in no case.  
 In O. M. S. C. cases the ear disease was right and left and double equally often.  
 In O. M. C. C. cases the ear disease was almost always double.

Of the 128 cases examined, 66 were children and 62 were adults.

Of the 15 strongly positive cases, 2 children and 3 adults gave specific histories; 1 adult was diabetic, and another gave a history very suspicious of syphilis. The serum from the mother of one of the children giving syphilitic histories reacted strongly positive to the test. The father of the other child had syphilis, and the child a syphilitic iritis.

Two children disappeared, but all the others were cured.

All the adults improved under antisyphilitic treatment.

Of the 21 weakly positive cases, of the 14 children, 5 disappeared, 6 were cured, 1 improved, 2 not improved. Of the 7 adults, 2 disappeared, 2 were cured, 2 improved, 1 not improved. One woman, who improved markedly under specific treatment, had syphilitic iritis, and nerve deafness in both ears. She had been under treatment for many years.

Of the 14 doubtful cases, of the 6 children, 3 disappeared, 1 was cured, 1 died of diphtheria, 1 did not improve. Of the 8 adults, 1 disappeared, 4 were cured, 2 much improved, 1 not improved.

Of the 78 negative cases, 1 adult gave a history of syphilis, but as she had been under treatment for the disease for many years, it is not surprising that repeated examinations failed to elicit a positive reaction. In this connection it is important to remember that the absence of a positive reaction does not absolutely disprove the existence of syphilis, but that the consensus of opinion is that its presence is strong evidence that the patient is infected with active luetic poisons.

In the 66 children hypertrophied tonsils and adenoids were present in 43 cases. Four of these cases gave strongly positive reactions. They were all in cases of chronic suppurative otitis.

The comparative frequency of positive reactions in children and adults is remarkable, as is also the percentage of males to females, and the ear diseases which seem to be most frequently accompanied with positive reactions in these two classes of patients. Strongly positive reactions occurred in 10 2/3% of the children and in 13% of the adults.

Weakly positive reactions occurred in 21 1/3% of the children and in 11% of the adults.

This gives a total strongly positive reaction in adults and

children of 11 2/3%. Note that in only 35 cases was there doubt as to the reaction, and that these percentages were calculated on the basis of counting all the doubtful reactions as negative, although it is fair to presume that some were really in syphilitics. If to the strongly positive cases we add the one weakly positive case and the one negative case giving specific histories (both in women), the total syphilitic percentage would be: in adults, 16%, and in adults and children, 13 1/3%.

Of the 128 cases examined, 58, or 45%, were males, and 70, or 55%, were females. The number of reactions occurring in males and females appears as follows:

## IN CHILDREN.

	Males.	Females.		Males.	Females.
Strongly positive.....	2	5	Weakly positive.....	1	13
			Doubtful .....	3	3
			Negative .....	19	20
				—	—
				23	36

## IN ADULTS.

Strongly positive.....	6	2	Weakly positive.....	2	5
			Doubtful .....	1	7
			Negative.....	24	1
				—	—
				27	27

## IN ADULTS AND CHILDREN.

Strongly positive.....	8	7	Weakly positive.....	3	18
			Doubtful .....	4	10
			Negative .....	43	35
				—	—
				50	63

In children it would appear that a positive reaction is about twice as prevalent in females as in males, taking into account the number of cases of each sex examined.

In adults it would appear that a positive reaction is nearly three times more prevalent in males, taking into due consideration the number of cases of each sex examined. Adding the two women who reacted negatively or doubtfully, but who gave



specific histories, the proportion of males to females would be as 3 : 2.

In adults and children the percentages were as follows:

STRONGLY POSITIVE.		WEAK, DOUBTFUL OR NEGATIVE.	
Males .....	6.25%	Males .....	39.00%
Females .....	5.50%	Females .....	49.25%
<hr/>		<hr/>	
11.75%		88.25%	

In other words, practically 12% of all the cases tested were positive, and the males furnished  $6\frac{1}{4}\%$ , and the females  $5\frac{1}{2}\%$  of these cases.

The diseases of the ear most frequently accompanied with positive reactions in children were the acute and chronic suppurations. Seven cases out of sixty-one in these diseases gave strongly positive reactions. The number of the other ear diseases in children was not sufficient to base any reliable calculations on the statistics thereof.

In adults nerve deafness was accompanied with a positive or suspicious reaction in every one of the five cases examined. In chronic catarrhal otitis media, five out of the twenty-nine cases examined gave a positive reaction. There were no strongly positive reactions in the suppurative cases in adults.

In the five cases of nerve deafness, three gave positive histories of syphilis, one a very suspicious history, and one no history of the disease.

Noguchi has published his results in diseases in which syphilis was an etiologic factor, or in which it could not be excluded as a possible cause of the condition, and among these the eye cases showed 50% positive reactions, and the brain tumor cases 50% positive reactions. These latter are particularly interesting to the otologist, and would indicate that in every case of brain tumor operation should be deferred until the blood serum has been tested for the syphilitic reaction.

The cases I examined were all suffering from some ear disease and, with one or two exceptions, appeared to harbor no other ailment at the time the tests were made. They are of unique interest, therefore, from the standpoint of the reliability of the test. Noguchi found in 335 cases in which syphilis could be excluded with a fair degree of certainty, that only

twelve reacted positively. Seven of these were leprosy, and five were scattered among five other diseases, including two malignant neoplasms and one scarlatina. Subsequently the scarlatina case proved to be syphilitic, and infected with this disease two surgeons who operated upon her. With the exception of leprosy, therefore, practically all were negative. The reason for the large proportion of positive reactions in leprosy is as yet unknown.

From the above, and from the remarkable coincidence of my histories of syphilis with the positive reactions, it is fair to presume that in my 128 cases the great majority, if not all, of those reacting positively to the test were, in fact, syphilitic, and that in many cases the ear disease depended, at least in part, for its inception, and in larger part for its chronicity, on some influence of the syphilitic taint in the tissues.

In children 50% of the cases examined were acute inflammations, and in these but two gave a positive reaction. In the chronic cases five were strongly positive, all in chronic suppurations. This would indicate that in children 15% of all chronic diseases of the ear are accompanied with active syphilis.

In adults nearly 50% of the diseases were chronic catarrhal otitis media and nerve deafness, about equally divided between the two sexes. It is startling to find that all the strongly positive reactions occurred in these cases. Almost one-fourth gave strongly positive reactions. Not one of the suppurative cases gave a positive reaction.

It is a recognized fact that the bones of the skull are frequently affected during the course of syphilis, that this process is usually extraordinarily slow, and not very infrequently may end favorably, but it is not generally taught that the diseases of the bony and connective tissue structures of and about the inner and middle ear are as often associated with syphilis as a study of my series of cases would lead one to believe. I can not go into this further in this paper, but I believe many cases of catarrhal sclerosing and suppurative otitis derive their tendency to chronicity, if not in large measure their inception, from the effects of acquired or inherited syphilis, and that these cases could be markedly benefited if the surgeon will keep in mind their possible presence and combine with his

other treatment a rational and energetic treatment of this terrible disease.

#### SUMMARY.

Syphilis is more frequently associated with diseases of the ear than clinical observations would suggest.

The reason for its non-recognition has been the lack of a reliable test for its detection, its denial by the patient or parents, and the failure on the part of the surgeon to look for the disease.

In Noguchi's modification of the Wassermann reaction we possess a simple, inexpensive and valuable test for active syphilis.

In children suffering from ear disease, females are congenitally syphilitic twice as often as males.

In adults the greater proportion having the disease is in the male sex.

The proportion of positive reactions in adults and children is about equal.

In children with ear disease the great majority of positive syphilitic reactions occur in cases suffering from suppurative diseases of the middle ear and its surrounding bony cavities.

In adults the greater number of positive reactions occur in cases of nerve deafness and chronic catarrhal otitis media.

The presence of hypertrophied tonsils and adenoids seems to bear no relationship to the complement fixation reaction.

Marked benefit to the auditory apparatus and to the general health regularly follows antisymphilitic treatment in cases giving a positive syphilitic reaction.

Approximately 12% of all diseases of the middle or internal ear give strongly positive reactions to the complement fixation test.

Syphilitic affections of the internal ear would appear, as a rule, to be late manifestations of the disease.

57 West 76th Street.

## XXIX.

### THE REPORT OF A CASE OF CEREBRAL ABSCESS OCCURRING IN CONNECTION WITH A CHRONIC MIDDLE EAR SUPPURATION.

BY HUGH B. BLACKWELL, M. D.,

NEW YORK.

In point of vagueness which serves to characterize its many atypical clinical manifestations, otitic temporosphenoidal abscess of the right hemisphere may be likened to a number of general bodily ailments, which frequently evince themselves by symptoms of an indefinite nature, and from which we are as often puzzled to make a differential diagnosis when confronted by this grave complication of middle ear infection.

Unfortunately, no single otologist has as yet, owing to their comparative infrequency, secured enough of these cases to have enabled him to solve the problem of their postoperative management, and for this reason it has come to be properly regarded as the duty of every surgeon to report all of the cases of brain abscess which occur under his observation, whether the result be successful or not. If in the discussion, which I hope will follow my few brief remarks, any light is thrown on the above question, I will consider that my obligation has been well discharged.

*History*—Patient, F. H., a woman, age 25, was admitted to the service of Dr. Robt. Lewis, at the New York Eye and Ear Infirmary, on May 1st, 1909, for radical operation, with the following history: About one year before this date she was suddenly seized with an acute attack of pain in her right ear. She had never suffered from ear trouble of any kind previous to this onset. This earache continued for several days, when a myringotomy was performed and the pain was relieved. Since that time there has been a profuse discharge of pus from the right ear, and for the past ten months it has been noticeably foul in odor. During this period there has been several at-



tacks of severe pain in the ear, accompanied by some headache, but no dizziness or vomiting.

On admission patient's general physical examination proved negative. Aural examination showed that the canal was filled with a profuse discharge of very foul pus. The fundus of the canal was occupied by several good-sized masses of polypoid granulation tissue. The drum was apparently destroyed, bare bone could be felt in the tympanum. There were no evidences of acute mastoid involvement. A few hours after admission the patient having been properly prepared, a radical operation was performed upon her right ear. The sigmoid sinus was found to be located far forward, and a small area of the vein wall was exposed just below the knee. It was of normal appearance. The middle fossa was low and overhanging, and while cleaning out the cells on the under surface of the tegmen tympani a small portion of the tegmen was removed. This opening was subsequently enlarged to about one centimeter square. The dura, which was exposed, was apparently healthy and not injured during this procedure. The posterior bony wall was next taken down, and quite a considerable quantity of polypoid granulations were removed from the tympanum, together with necrosed ossicles, etc. The operation was now completed in the usual manner, the wound was cleansed, flushed with alcohol and a dressing applied, the posterior wound being entirely united and iodoform gauze being used as tympanic packing.

On the day following the operation the patient complained of some headache and nausea, which were attributed to the usual causes. On the following day the headache persisted, although the nausea was better. On the third day the entire outside dressing was removed, revealing the soft parts in a normal condition. From the third to the eighth day temperature ranged from 99° to 101°, and the headache became much more severe, being paroxysmal in character. On the fifth day the tympanic gauze was removed, revealing a perfectly normal cavity. The posterior wound had healed by first intention. On the eighth day the temperature became normal, and remained practically so until the thirteenth day. During this time the headache still continued. On the eleventh day blood examination showed 13,200 leucocytes, with 76% of polymorphonuclear cells and malarial examination negative. On the

thirteenth day another examination showed 10,500 white cells, 72% of polymorphonuclear cells. Malarial examination negative. On the morning of the thirteenth day temperature was 100, fundi normal, and in the afternoon, for the first time, patient began to show evidences of stupor and somnolence; pulse around 50 and 60. She was very slow to answer questions, but there was no aphasia or paralysis. The somnolence rapidly increased, and on the same afternoon she was removed to the operating room. The patient having been properly prepared, an incision was carried down through the old cicatrix and extended forward from its upper extremity almost to the external angular process of the frontal bone. A posterior cut extending backward two inches from the old incision was then made. The soft parts, including periosteum, having been elevated, were retracted, and the entire bony floor of the middle fossa down to the antrum was removed. The dura over the tegmen antri, which was exposed during the primary radical operation, was found to be in a normal condition, covered with healthy red granulation tissue. On removing the skull covering the external surface of the temporosphenoidal lobe, there was observed a bulging spot in its cortex, about the size of a dime, located in the middle temporal convolution and about on a vertical line drawn through the external auditory canal. A brain knife was then inserted into this bulging area and passed downward, forward and inward for a distance of about  $1\frac{1}{2}$  inches and turned at right angles. Instantly the pus, thick, creamy, yellow, non-odorous, and evidently under great pressure, spurted up alongside the handle of the knife. This opening in the dura was now extended to about one inch in length, and a pair of closed, smooth thumb forceps cautiously introduced between the lips of the incision and passed into the abscess cavity. They were then allowed to open. In this way a very good view of its interior was obtained. The abscess apparently had no walls, being lined by softened dark brain tissue. Fully one ounce of pus was evacuated. An incision was now made into the under surface of the temporal lobe, just above the antrum, and carried up to the abscess cavity. Two bone tubes were then inserted into the external cortical, and one in the inferior cortical incision, until their extremities were felt to meet in the interior of the abscess cavity, in this manner establishing drainage in both directions

from the infected area. The wound was now lightly packed with iodoform gauze and an external dressing of wet saline applied. While under the anesthesia and before the opening of the abscess the patient's pulse ranged from 48 to 68. Immediately after the evacuation of the abscess it was 108, and at the close of the operation 72.

On the day following the operation patient's general condition was very much improved. Sensorium was comparatively clear. For the first time in two weeks the day passed without an attack of headache. The wound was dressed, there was no evidence of hernia, but a very profuse discharge. The patient lived for ten days after the operation, during the first nine of which the temperature ranged irregularly from  $99^{\circ}$  to  $104^{\circ}$  and pulse from 72 to 100. The wound was dressed every day, and on each alternate day the bone tubes were taken out, cleansed and then replaced. On the 19th, or five days after the evacuation of the abscess, owing to the improved wound condition and the diminution of the discharge, the inferior drainage tube was removed. Two days later patient's temperature rose to  $104^{\circ}$ . An encephaloscope was then used for the first time to explore the abscess cavity. This was thoroughly done, with a negative result. The inferior drainage tube was then replaced. On the following day the temperature was somewhat lower, but the patient was very restless. On dressing the wound a moderate sized brain hernia was, for the first time observed, presenting from the external surface of the cerebrum. This was left alone. On the next day the hernia was about twice as large, being now about the size of a small orange. Most of the extruded tissue being necrotic, was clipped off. The discharge was of a very foul odor. Patient's general condition was much worse, evincing all of the symptoms of a general meningitis. Temperature,  $105^{\circ}$ ; pulse, 148; stiff neck, delirium, strabismus, etc. Death took place on the following day, preceded by an antemortem rise of temperature to  $107.4^{\circ}$ .

The interesting points occurring in connection with this case are:

First—Did the abscess develop subsequent to the performance of the radical operation? And, if so, was the dural exposure a factor in its causation?

Second—Granted that the abscess was present in a cold



or latent condition prior to the radical operation, did its performance serve to excite the cold process into full activity, digest its walls, etc.?

Third—Are we justified in performing the Stacke operation in cases which present this symptom of intense paroxysmal headache, which we cannot attribute to other causes, without at the same time making exploratory punctures of the brain, even though the cardinal symptoms of abscess, such as somnolence, slow pulse, aphasia, paralysis, etc., be absent. Certainly had this course been pursued in the present case the patient's chances of recovery would have been infinitely greater.

The facts as demonstrated by the case are:

First—The apparent impossibility of making an absolute diagnosis in all cases of right-sided abscess of the temporo-sphenoidal lobe during an initial or latent abscess condition.

Second—The importance of recognizing the condition and operating during the initial period of the disease.

In conclusion, I would add that, despite the present unfavorable experience, I am in favor of using some rigid tubular instrument with noncollapsible walls for purposes of drainage in these conditions, and also of making counter-openings through the floor of the temporosphenoidal lobe, whenever the abscess occurs fairly low down in that structure. In the present case, the diffuse encephalitis, as evidenced by the hernia cerebri, did not take place until after the inferior drainage tube was withdrawn. I believe that its use greatly facilitates the escape of septic material, which would otherwise be apt to accumulate in this, the most dependent portion of the wound.



### XXX.

## LATENT MASTOIDITIS WITH EPIDURAL ABSCESS.

BY ALFRED BRAUN, M. D.,

ASSISTANT SURGEON, MANHATTAN EYE, EAR AND THROAT  
HOSPITAL,

NEW YORK.

We have all met with cases of mastoiditis, of all grades of severity, from the slight congestion of the mastoid process, which accompanies a large proportion of the cases of acute middle ear suppuration and which clears up spontaneously in a few days, to the cases which give rise to serious intracranial complications and often end in death.

However, it is often difficult to decide, from the clinical picture, as to how serious a case of mastoiditis we have to deal with. The severity of the clinical symptoms is not always in accord with the extent of the pathologic changes.

In the past six months the writer has had under his observation five cases in which there was a very close similarity in the clinical appearance and course, as well as in the pathologic findings, but in which the severity of the actual disease process was out of all proportion to the seriousness of the clinical symptoms.

In all five cases operation showed extensive destruction of the mastoid cells with erosion of the inner table and epidural abscess. In no case did the patient feel sick enough to go to bed. Four of the cases were in laborers and the fifth was a housekeeper. All kept on attending to their work until the last minute. In each case it was extremely difficult to persuade the patient that he was sick enough to require an operation.

They began with symptoms of a mild suppurative middle ear inflammation, with slight or no pain, some deafness, and ringing in the ear. In one of the cases there was no discharge,

except for a few days at the beginning of the disease. In the other four cases there was a moderate discharge throughout the disease.

There was some edema of the posterosuperior canal wall in all of the cases. A slight amount of mastoid tenderness on very deep pressure, was present, at times, in all of the cases. Most of the time there was no tenderness at all. In three of the cases there was slight edema over the mastoid for a few days before operation.

The temperature was never above 99.5° F. in any of the cases. Most of the time there was no elevation of the temperature.

The disease extended over a period of six to twelve weeks (one of the cases lasting six months), with periods when there were absolutely no local symptoms of mastoiditis.

However, there was something in the general appearance of the patients—in the facial expression and color—which showed that there was some serious trouble going on.

The cases were all seen in Dr. Berens' service, at the Manhattan Eye, Ear and Throat Hospital.

CASE 1.—Sarah O., age 49 years, a housekeeper, was first seen on August 5, 1909. She complained of a feeling of fullness, deafness and ringing in her right ear, for one day. There was no pain. Examination disclosed a red, bulging drumhead. A paracentesis was done, liberating a small amount of mucopurulent discharge. Hot bichlorid irrigations were ordered. There was a slight improvement in the subjective symptoms for two days. Then she complained of a little pain behind the ear. There was a slight tenderness over the mastoid, which disappeared in a day or two. Moderate purulent discharge. Some edema of posterosuperior canal wall. General condition good. No elevation of temperature. Attends to her work of keeping house for a doctor.

On September 7th, four and a half weeks after the onset of the disease, there was again slight tenderness over the mastoid antrum, on very deep pressure. There was no pain. The patient merely complained of a feeling of fullness and numbness in the ear. The otoscopic picture was the same as before. There was a moderate sized perforation of the drumhead, with a slight purulent discharge, and edema of the posterosuperior canal wall. No temperature. On account of the persistence

of symptoms, even though slight in degree, over so long a period of time, operation was advised, but refused. Patient says she does not feel sick and has no pain, and cannot believe there is anything seriously wrong with her. Continues to attend to her work.

September 9th, condition is the same. Operation again advised. Patient promised to come into the hospital the next day, but did not come. When again seen, on September 11th, patient says she feels much better. The ear doesn't feel so full.

On September 13th, temperature is  $99.2^{\circ}$  F. Slight edema over the mastoid. Patient says she feels good. Operation again advised. Patient consents to come into the hospital the following Monday, as she had some work to do until then.

On Saturday, September 18th, she was again seen. The postauricular edema had increased. Mastoid tenderness a little more marked. No pain. Temperature,  $99^{\circ}$  F. Operation consented to.

Operation showed a very thin cortex, mastoid cells and antrum broken down and full of pus. Inner table eroded over sinus, over an area about three-fourths of an inch in diameter. Perisinus abscess.

Recovery was uneventful.

CASE 2.—Peter S., 54 years of age, a fireman, was first seen on May 29, 1909. He had had a cold in April, about six weeks before he appeared at the clinic, followed by slight pain in the left ear. The ear began to discharge in a couple of days, upon which the pain disappeared. There was a feeling of numbness and itching in the ear, and some deafness. Bichlorid irrigations were ordered, and the discharge stopped after two weeks. In the beginning of July the ear began to discharge again. There was no pain. Occasionally he had a slight amount of tenderness over the mastoid, for a day or two. He had no elevation of temperature at any time. He always attended to his work.

On July 15th operation was advised and refused.

On July 25th, 1909, there was a slight edema over the mastoid and in the posterosuperior canal wall. No pain or tenderness. He was admitted to the hospital, and operated on the next day, which was a little over three months since the onset of his trouble.

Operation showed a very thick, dense cortex. Interior of mastoid broken down and full of pus. Inner table eroded in the angle between sinus groove and middle fossa. A large epidural abscess, about two inches in diameter, extending over sinus, middle fossa and cerebellum was uncovered.

Culture from pus showed a mixed variety of bacteria.

Uneventful recovery.

CASE 3.—Patrick R., aged 35 years, a motorman, was first seen at the clinic, on July 15, 1909.

Three weeks before, he had had slight pain in his right ear, with discharge. Discharge and pain stopped in a few days. At times he felt perfectly well. Deafness and ringing in the ear. He continued to attend to his work.

Otoscopic examination showed his drumhead to be reddened and thickened, but not bulging. No perforation. Some edema of posterosuperior canal wall. He was given bichlorid irrigations. He had occasional slight pain in the ear, which would last for a few hours, and then he would feel well.

On August 10th, about eight weeks after the onset of his disease, there was slight tenderness over the mastoid antrum, on very deep pressure. No temperature.

Operation was finally consented to, after much urging, and was performed on the following day.

Operation disclosed a very thick cortex. The mastoid was very badly diseased. There was much pus. Erosion of inner table; with an epidural abscess extending over an area  $1\frac{1}{2}$  inches in diameter, above the knee of the sinus, and over the dura of the middle fossa.

Recovery was uneventful.

CASE 4.—John P., 22 years of age, a laborer, was first seen on March 11, 1909. Six weeks previously he had had slight pain with discharge and tinnitus in his left ear. The discharge persisted. The pain disappeared after a few days. Complained only of deafness and a dull feeling in his ear. He attended to his work all the time.

Examination showed a moderate sized perforation in the drum membrane, with purulent discharge. Some sagging of posterosuperior canal wall. Slight tenderness over the mastoid, on very deep pressure.

He was operated on the next day.



Operation showed a very thick cortex. Mastoid full of pus. Large epidural abscess over sinus and middle fossa.

Culture from pus showed extracellular diplococci.

Recovery was uneventful.

CASE 5.—James S., a bartender, 40 years of age, went in bathing on June 28th, 1909. The next morning he had severe pain in the right ear, which lasted four days, at which time the ear began to discharge. With the onset of the discharge, the pain disappeared. He went to the Brooklyn Eye and Ear Hospital, where he was treated for a week. On July 15th he came to the Manhattan Eye, Ear and Throat Hospital, complaining of some buzzing in the right ear and a profuse discharge. Examination showed a canal filled with granulations bathed in thick, creamy pus.

Bichlorid irrigations were ordered and the granulations removed several times. They recurred as fast as they were removed. The profuse discharge persisted. At the end of July there was slight tenderness over the mastoid. Operation was advised and the patient disappeared. He was not seen again until December 18, 1909, six months later. He said that he had been feeling perfectly well since I had last seen him, except that the discharge had persisted. He had had no pain whatever, and had always attended to his work.

Three days ago he began to have pain behind the right ear and some swelling. He thought it was probably a boil.

Examination showed the canal full of granulations and thick, creamy pus. There was some edema and tenderness over the posterior portion of the squama. The mastoid was not tender. Temperature 99° F., pulse 80.

A radical mastoid operation was done. As soon as the periosteum was reflected there was a gush of pus from a perforation about a quarter of an inch in diameter, situated in the posterior part of the squamous portion of the temporal bone. This led down to a large epidural abscess lying over the cerebellum, sinus and temporosphenoidal lobe. The dura was covered with granulations half an inch thick.

Culture from pus showed extracellular diplococci.

Recovery was uneventful.

It seems to me that there is a very obvious lesson to be drawn from a study of these cases, namely, that in cases of acute middle ear suppuration, where symptoms of mastoid involvement, no matter how slight, have extended intermit-

tently over a long period of time, it is our duty to advise immediate operative intervention.

Another point that I would like to bring out is this: Where the symptoms of an acute mastoiditis have subsided under conservative treatment, and after several weeks or months of good health, the symptoms recur, we are not dealing with a second attack of mastoiditis, in the majority of cases. We will usually find that the disease has been progressing continuously since the first attack, and these cases always show very extensive bone involvement with (not uncommonly) some intracranial complication. These cases should be operated on immediately upon recurrence of the symptoms.

Just why an acute mastoiditis should cause intense pain and severe systemic symptoms in some cases and should be practically painless, with scarcely any general symptoms in others, is very hard to say. It is not due to the character of the infecting organism, because various organisms were found in my cases.

In all of the cases the pus was under considerable tension, for when the cortex was removed the pus welled out with great force. In one of the cases there was fully an ounce of pus lying on the dura, and in another case about half an ounce, yet there was no headache or other sign of increased intracranial tension at any time.

The only way that I can explain the behavior in these cases is by assuming that the accumulation of pus, being very slow, the tissues had time to adapt themselves to the increased tension.

Of course, it is possible that these were all individuals with a diminished susceptibility to pain. We have all noticed, for instance, how differently patients behave when a paracentesis of the drum membrane is done without anesthesia. Some patients complain most bitterly of the pain, while others, even comparatively young children, say that the pain is very insignificant.

However, this lack of nerve sensitiveness would not explain the absence of general systemic symptoms. But we know that septic absorption from bone cavities is very slow, and a vigorous patient, with good resisting power, might easily dispose of the small amount of toxin as quickly as it is set free in the system.

156 East 61st Street.

## XXXI.

### REPORT OF TWO CASES OF LATERAL SINUS THROMBOSIS TREATED, POSTOPERATIVELY, WITH HISS' EXTRACT OF LEUCOCYTES.

BY SAMUEL McCULLAGH, M. D.,

NEW YORK.

In presenting a report of two cases, the writer fully realizes the futility of trying to draw any definite conclusions therefrom, but he feels that the results obtained from the administration of this extract were beneficial and therefore of interest, while in many other cases suffering from infections not coming within the range of our specialty, very favorable ones have been obtained.<sup>1</sup> For that reason he desires to call its use to the attention of those members of this section who are not already familiar with it, in the hope that a wider application may be obtained and its ultimate utility thereby determined. In lateral sinus thrombosis, exclusive of surgical intervention, our therapeutic resources are so meager and, if the knife has failed to relieve, so pitiful, that it behooves us to investigate with care anything promising aid in reducing the heavy mortality of this frightful condition. This extract interferes in no way with any other measures employed and so is an added weapon in our armamentarium. In these cases the prompt checking of the infection before the system is overwhelmed by the toxemia is such an important factor that where the isolation and cultivation of the specific microorganism of a given case with the preparation of a serum suitable for that case is necessary, the chances are that the critical point has been passed before the serum is ready for use. In other words, either by surgical intervention the focus of infection has been completely removed and the resistance of the patient has been able to check and overcome the toxemia, or it has been but partially removed, the manufacture of toxins proceeds unchecked and the resistance of the patient has been materially lowered

by the shock of a severe operation. Our knowledge of the thoroughness of the eradication of the focus is determined only by the subsequent course of the disease. Hope alternates with fear. How invaluable would be a remedy that would actively fortify the patient's resistance against the present toxemia and the danger of development of secondary foci!

This is neither the time nor the place nor has the writer the desire or ability to discuss the various theories as to immunity or the modes of action in serum or allied therapy. However, the following brief quotations from articles of Hiss, in which he describes this extract, are very much to the point. He says: "We have a differentiation of immunizing agents into those which, by virtue of their liberation and overproduction by the cells, such as antitoxins, amboceptors, agglutins, etc., are free in the plasma, and thus when active are immediately available for the protection of all the body cells; and into those agents by which certain cells primarily nourish and protect themselves, and are only of benefit to the cell community at large by virtue of the direct intervention of these cells between the invading germs and their products and the highly specialized cells requiring protection."<sup>2</sup> The cells which intervene are the leucocytes. In his Harvey lecture, after discussing the type of immunity, a large part of the mechanism of which is individually cellular by phagocytosis and digestion and neutralization of endotoxins, he says: "It was this thought which suggested to me the idea of treating disease by aiding the leucocytes by furnishing them as directly as possible with the weapons which were being taken away from them in their fight with invading microorganisms, and to protect them thus from destruction and give them an opportunity to recuperate and carry on successfully their struggle against the invading germs. These weapons, whatever might be their nature, I assumed might possibly be furnished by an extract of the active substances of the leucocytes themselves—substances not ordinarily given up to the plasma or serum—and I also assumed that extracts would be more efficacious than living leucocytes themselves, introduced into the infected animal, since, if diffusible, they would be distributed impartially to all parts of the body by the circulatory mechanism and, as quickly as absorption would permit, relieve the fatigued leucocytes and protect, by any toxin-neutralizing or other power



they might possess, the cells of highly specialized functions."<sup>3</sup>

*Preparation of the Extract.*—This extract of leucocytes is usually obtained by double pleural inoculations of normal rabbits with a solution of aleuronat. This causes a sterile pleurisy with effusion, and the amount obtained after 24 hours is usually 30 to 60 cc. of turbid and often blood-stained serum. This is quickly centrifugalized, the serum decanted and the cell residue extracted in sterile distilled water for periods of from five to ten hours. A standardization of 20,000,000 leucocytes to 10 cc. of solution is made. After a few hours at  $37\frac{1}{2}^{\circ}$  C. the extracts are preserved in the ice-box. Just prior to using, the tubes are shaken and all the contents used.

The following is a brief summary of the two cases. Both were in the service of Dr. Berens, at the Manhattan Eye, Ear and Throat Hospital:

Emma S., age 33, admitted November 12, 1908, with symptoms of acute mastoiditis on the left side, following an intranasal operation two weeks previously. A free paracentesis was performed. There was no abatement of the symptoms under treatment for 48 hours. On the contrary, the pain and tenderness increased, and there was a persistent elevation of temperature.

November 14.—A simple mastoidectomy was performed. An attempt was made to heal the wound by a modified blood clot. A temperature of  $99\ 3-5^{\circ}$  at the time of operation fell to normal eight hours later.

November 15.—Maximum temperature  $102^{\circ}$ , minimum  $99\ 3-5^{\circ}$ . Severe pain in right ear, with redness and bulging of the drum. Paracentesis.

November 16.—Maximum temperature  $103\ 2-5^{\circ}$ , minimum  $100^{\circ}$ . Some redness and edema around wound and over scalp. Wound freely opened.

November 17.—Maximum temperature  $104\ 4-5^{\circ}$ , minimum  $102\ 1-5^{\circ}$ . Coughs frequently. Respiration irregular.

November 18.—Maximum temperature  $104\ 1-5^{\circ}$ , minimum  $102^{\circ}$ . Cough persists. Expectoration contains small particles of blood. Patient slightly delirious. Examination of chest negative. Differential blood count: Leucocytes 24,200, polynuclears 89%.

November 19.—Maximum temperature  $105^{\circ}$ , minimum  $101^{\circ}$ . Chill. Cough persists. Blood-stained mucus expec-

torated. Chest examination negative. Right drum membrane again incised.

November 20.—Maximum temperature  $104\ 4\text{-}5^{\circ}$ , minimum  $100\ 3\text{-}5^{\circ}$ . Absolute deafness in both ears. No granulation tissue in wound, which is covered with a dirty gray slough. No pneumococci found in sputum. Differential blood count: Leucocytes 11,170, polynuclears 90%.

November 21.—Maximum temperature  $104\ 1\text{-}5^{\circ}$ , minimum  $100\ 2\text{-}5^{\circ}$ . Second operation. The sinus was found collapsed and its wall excised. Free bleeding was established from the torcular end. The jugular vein was found thrombosed. It was ligated as low down and as high up as possible and exsected. The thrombus extended below the lower ligature. The patient withstood the operation fairly well. The delay in operating was due to doubt as to whether we were dealing with a larval pneumonia, basilar meningitis by extension through the internal ear, or sinus thrombosis.

November 22.—Maximum temperature  $103\ 4\text{-}5^{\circ}$ , minimum  $100\ 2\text{-}5^{\circ}$ . At 9 p. m. 20 cc. of Hiss' extract were injected beneath the skin of the abdomen. The temperature at this time was  $102^{\circ}$ . At 12 p. m. and 3 a. m. it was  $100\ 2\text{-}5^{\circ}$ , a drop of  $1\ 3\text{-}5^{\circ}$  in three hours, but the temperature was falling at the time the injection was given.

November 23.—Maximum temperature  $104^{\circ}$ , minimum  $99\ 2\text{-}5^{\circ}$ . Marked dysphagia has developed. At 9 p. m., the temperature being  $103\ 4\text{-}5^{\circ}$ , 24 hours after the first injection, a second injection of 24 cc. was given, followed in 12 hours by a drop of two degrees. The temperature at this time was on the decline also.

November 24.—Maximum temperature  $103\ 2\text{-}5^{\circ}$ , minimum  $101\ 4\text{-}5^{\circ}$ . Dysphagia very marked. Pneumonia on right side with well marked edema of the left lung. Delirious. Face and extremities markedly cyanosed.

November 25-26.—Maximum temperature  $103\ 4\text{-}5^{\circ}$ , minimum  $99\ 2\text{-}5^{\circ}$ . Condition unchanged.

November 27.—Maximum temperature  $104\ 4\text{-}5^{\circ}$ , minimum  $100\ 1\text{-}5^{\circ}$ . Condition practically unchanged. Oxygen has been given almost continuously for the past four days.

November 28.—Maximum temperature  $102\ 1\text{-}5^{\circ}$ , minimum  $100\ 2\text{-}5^{\circ}$ . The crisis of the pneumonia occurred four days after its onset. The patient was unconscious, extremely cyan-

used, with very irregular and labored respirations. Her death was momentarily expected. At 9 p. m., the temperature being  $100\ 3\text{-}5^{\circ}$ , 20 cc. of extract were injected, followed in 6 hours by a rise of  $1\ 2\text{-}5^{\circ}$  to  $102^{\circ}$ , from which point it fell in 9 hours to  $98\ 3\text{-}5^{\circ}$ , with a natural sleep of several hours' duration. An examination of the eye grounds on this day showed hyperemia of the disks and the whole fundus, having the early pathologic appearance of neuritis. Disks slightly swollen.

November 29.—Maximum temperature  $103\ 4\text{-}5^{\circ}$ , minimum  $98\ 3\text{-}5^{\circ}$ . Dysphagia disappearing.

November 30.—Maximum temperature  $103\ 2\text{-}5^{\circ}$ , minimum  $99\ 3\text{-}5^{\circ}$ .

December 1.—Maximum temperature  $99\ 4\text{-}5^{\circ}$ , minimum  $98\ 1\text{-}5^{\circ}$ . Leucocytes 13,000, polynuclears 70%.

December 2.—Maximum temperature  $103\ 2\text{-}5^{\circ}$ , minimum  $100^{\circ}$ .

From this time on the temperature was practically normal through convalescence. The deafness, which had been almost absolute, gradually subsided and good hearing was restored. Time does not permit me to allude to the other therapeutic measures resorted to in this case which were used to combat symptoms as they arose only.

Nellie B., age 8, was admitted the night of December 17, 1909. There was a history of intermittent discharge from the left ear since early childhood. The ear had been dry for some little time before the onset of the present attack, which started one week ago, with pain in and behind the ear, but with no discharge. The temperature at the time of admission was  $104\ 1\text{-}5^{\circ}$ . There were symptoms of meningeal irritation and tenderness over the mastoid. Paracentesis was performed.

December 18.—Simple mastoidectomy was performed. The sinus was exposed and found collapsed. There was no free pus around the sinus, but a very foul-smelling gas escaped when the inner table was broken through. The sinus wall was excised, and free bleeding was established from the torcular end. The jugular vein was then ligated and excised. The patient was in very bad condition when removed from the table. During the four following days the temperature ranged between 105 and 101, and the condition of the patient became progressively worse, presenting the characteristic picture of an advancing septicemia.



December 23.—Maximum temperature  $103\ 3\text{-}5^{\circ}$ , minimum  $101\ 4\text{-}5^{\circ}$ . At 3:30 p. m. the temperature at that time being  $103\ 3\text{-}5^{\circ}$ , 10 cc. of Hiss' extract were administered, followed by a fall in eight hours to  $101\ 4\text{-}5^{\circ}$ , the lowest point it had touched since December 20.

December 24.—Maximum temperature  $102\ 4\text{-}5^{\circ}$ , minimum  $101\ 4\text{-}5^{\circ}$ . At 9:15 a. m. 10 cc. of extract were given, the temperature being  $101\ 4\text{-}5^{\circ}$ , followed in two hours by a rise of  $1^{\circ}$ . Two hours later it had fallen to  $101\ 4\text{-}5^{\circ}$  again. At 9 p. m. 10 cc. were again administered, the temperature being  $102\ 1\text{-}5^{\circ}$ . Three hours later the temperature had risen  $3\text{-}5^{\circ}$ , falling in twelve hours to  $100\ 4\text{-}5^{\circ}$ .

December 25.—Maximum temperature  $102\ 4\text{-}5^{\circ}$ , minimum  $100\ 4\text{-}5^{\circ}$ . At 9:45, 10 cc. of extract were given, the temperature being  $101\ 1\text{-}5^{\circ}$ . Three hours later it was  $2\text{-}5^{\circ}$  lower. The patient was much brighter.

December 26.—Maximum temperature  $102\ 2\text{-}5^{\circ}$ , minimum  $100^{\circ}$ . Ten cc. of extract were given at 3 p. m. The temperature was unchanged three hours later. The patient passed a restless night.

December 27.—Maximum temperature  $101\ 4\text{-}5^{\circ}$ , minimum  $100^{\circ}$ . Patient passed a very comfortable night and day.

December 28.—Maximum temperature  $100\ 1\text{-}5^{\circ}$ , minimum  $98\ 4\text{-}5^{\circ}$ .

The convalescence from this time on was uninterrupted.

A specimen of blood taken from a vein of the arm at the time of operation was contaminated, but an examination of a section of the clot from the jugular vein showed many cocci.

It may be justly argued, without fear of successful contradiction, that practically no proof capable of substantiation has been adduced that this extract was influential in the happy termination of these cases. The writer freely admits it. But his firm conviction, established by constant observation of the patients whose histories are here briefly given, is that this extract was a very useful adjuvant in the treatment. This was especially so in the second patient, where no complications existed, and the extract was given fairly early, and with a degree of regularity. The rapid clearing up of the toxicemic depression of the central nervous system was the most striking feature. There was no constant effect on the temperature in either case.



It would be a waste of your time to suggest the infections of various localities and varying types in which this extract may be useful. The mode of action claimed for it opens up a very wide field to the vision of all. In conclusion the writer would urge that a fairer test of its usefulness can be made if it is administered early and regularly and not used as a last resort, as was the case in the first patient whose history has been given. Hiss recommends a dose of 10 cc. used as early as possible and repeated at frequent intervals—every three hours if necessary.

## XXXII.

### THE USE OF VACCINES, SERUMS AND THE HISS EXTRACT OF LEUCOCYTES IN THE TREAT- MENT OF EYE, EAR, NOSE AND THROAT INFECTIONS, WITH REPORTS OF CASES.\*

BY J. G. DWYER, M. A., M. D., C. M.,

NEW YORK.

The expansion in growth of serum and allied therapy in the last few years, especially following the impetus it received when Wright, of London, published the results of his work on opsonins, has been so great and has opened up such new avenues for investigation, that the practitioner finds himself literally swamped by a deluge of new scientific terms, new methods of diagnosis and treatment and by a mass of literature on this important and fascinating subject. It is a matter of no small difficulty for the man busy with his everyday affairs to keep pace with this growth. This is more especially so if he is not trained to some extent in laboratory methods, as the use or administration of these measures is not a simple matter and belongs, not to the province of the clinician alone or to that of the pathologist alone, but rather to a combination of the two. Hence it is that the importance of these therapeutic measures is not more generally recognized, the indications and contraindications for their use are not borne in mind and their limitations are not sufficiently realized. It is with the hope of emphasizing these few facts that I present to you to-night the results of my work along these lines during the last three years. At the same time I take this opportunity of sounding a note of warning against the indiscriminate use of these methods without due consideration of the suitability or unsuitability of the cases and, what is perhaps more important, the ability

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\*Read by invitation before the New York Academy of Medicine, Otological Section, March 11th, 1910.

of the man intelligently to use them, as more harm than good undoubtedly results from their administration in certain cases. This is not intended as a lengthy dissertation on this subject, but the endeavor has been made to give, in as brief and intelligent a way as possible, from an unbiased point of view, the practical results, reporting the failures as well as the successes and giving the conclusions to be drawn therefrom. In order to understand the criticisms and objections advanced against certain measures, it has been necessary for me to introduce certain scientific terms which are probably not familiar to everybody, but this has been done only where absolutely necessary.

In the first place, I will give a brief resumé of the work done, together with the results. In the majority of cases, vaccines were used; in the others, the Hiss-extract of leucocytes. The second part of the paper will deal with the relative values of the various measures, the underlying principles and the indications and contraindications for their use.

Some two hundred or so cases were examined as to their suitability for vaccine treatment. Of this number, some 105 were selected, the balance being rejected for various reasons; some, because they were unable or unwilling to come for continued treatment; others, because the causal organism could not be isolated from the mixture of bacteria present in the discharge. Tabulating the cases on the basis of the offending organism, the list is as follows: Tubercle bacillus, 20; staphylococcus, 47; streptococcus, 7; gonococcus, 3; pneumococcus, 1; bacillus pyocyaneus, 7; bacillus catarrhalis, 3; bacillus of Friedländer, 3; bacillus of Frisch (rhinoscleroma), 2; mixed infection, 3; bacillus unknown, 9. The list of diseases is not limited to those of the nose and throat, but includes also some interesting general diseases and several cases of eye infections.

The tubercular bacillus cases comprised the following: Chronic tuberculosis of the lungs, 3; of the intestines, 1; of the bladder, 1; cervical glands, 6; larynx, 4; iris, 1; cornea, 1; also 2 cases of phlyctenular conjunctivitis and keratitis and 1 case of episcleritis. The results, on the whole, of tuberculin therapy, have been very satisfactory. In all the cases a diagnosis of tuberculosis was made by the various means at our disposal, such as the general physical examination, examination of the sputum and other excreta, the Von Pirquet cuta-

neous test and the Calmette ophthalmic reaction, also by the reaction to the injection of tuberculin. The kinds of tuberculin used were the bacillus emulsion and the new tuberculin of Koch, known as Tuberculin T. R. Of the three lung cases, two were discharged as cured, and the third is continuing treatment in another city, still showing marked improvement. The intestinal case was a very instructive one, illustrating well one of the points to be considered later. The patient was in the pyrexial stage, having fever and symptoms of a systemic intoxication. The opsonic index was considerably over unity. However, injections were started, with the idea of still further raising this. Under the treatment the patient grew rapidly worse, and after a time the injections were stopped. Improvement then took place for a couple of months, but the patient eventually succumbed. This was one of my first cases, and I feel that harm was done. The case of cystitis was markedly benefited. Before treatment the patient had to urinate about fourteen times each night, while now he urinates only twice each night, and his whole general condition has improved, and I confidently look for still further progress in his case. The cases of tuberculous cervical adenitis have certainly been most satisfactory, and the results obtained here have amply repaid me for the long time spent in the treatment and the perseverance and constant care which it necessitated. Six cases were treated and all were cured. One patient, in particular, had undergone four operations, and when she came for tuberculin treatment had another mass of enlarged glands and was markedly disfigured by the thickened, unsightly scars at the sites of the previous operations. Under a course of tuberculin the enlargements disappeared, so that the glands were no longer palpable and, what was quite surprising and the more agreeable, the scar tissue seemed to undergo a certain amount of absorption. This was about two years ago, and no recurrence has taken place and the patient is in good condition. In the light of my experience and that of others with such cases, where the condition has not advanced to the stage of caseation or of breaking down, operation is not justifiable, as careful attention to general hygienic conditions and the administration of tuberculin, the dose varying for each case, according to the calculated index and the clinical symptoms, will often suffice to save them from the mutilation of the often unsuccessful sur-



gical measures which are now resorted to. Even in cases of caseation and where breaking down is inevitable, a course of tuberculin preceding and following the operation will be of great benefit. The four cases of laryngitis were instructive. The first was primary in the larynx, that is, primary in that no other lesion could be made out. This case was fairly well advanced, but responded to the treatment and was cured. The second case had a demonstrable lung lesion in addition to the local lesion. Marked improvement took place, but the lack of proper facilities at home led me to recommend her removal to a tuberculosis sanitarium, where her improvement has gone on steadily. The other cases had, in addition to the local and lung involvement with tuberculosis, a secondary infection with streptococcus. Neither showed any improvement. Later, judging from the published reports of others, who have treated such cases with alternate injections of tuberculin and streptococcus vaccine, the results have been more satisfactory. The remaining cases of tuberculosis were all cases of eye infections. The case of iritis was interesting. A comparatively large, well circumscribed tumor mass was present on the anterior surface of the iris, and there was a question of diagnosis between syphilis and tuberculosis. The history was negative as to the former, and tuberculin was injected on two occasions, not for the purpose of treatment, but purely for diagnostic purposes. Much to my surprise, the mass began to get smaller, and under continued treatment by injection of tuberculin eventually disappeared. The other cases gave the cutaneous reaction to tuberculin, and in the case of tuberculous keratitis, although the case was not an early one, it quieted down under treatment. The cases of phlyctenular keratitis ceased to have the recurrent attacks which had previously been so frequent. The same is true of the case of episcleritis. These cases are now entirely free from these attacks.

The next series of cases comprises the staphylococcus infections. Here 47 cases were treated and, with one exception, all were cured. The list was made up as follows: General furunculosis, 9; acne, 2; carbuncle, 1; eczema of the auricle, 1; otitis externa diffusa, 3; otitis externa circumscripta, 21; otitis media suppurativa subacuta, 5; chronic tonsillitis, 3; peritonsillar abscess, 1; abscess of the septum, 1. The list may not appear very impressive at first glance, but these cases were all

chosen because of their known chronicity and comprised that class which ordinarily does not yield to the other well-known methods of treatment, infection after infection occurring. One case of acne was of fourteen years' duration, and every kind of treatment had been tried, time and time again, without relief. This patient has now been entirely free for over two years. The otitis externa cases were of that fairly numerous class, which is the despair of the otologist, attacks constantly recurring. All these yielded readily to treatment with the vaccine. Under the heading of subacute ear cases are placed that large class in which, after the acute infection has run its course, the suppuration continues and eventually becomes of the chronic type. Five such cases were treated. Three ceased discharging, after practically the first injection; in the fourth, the discharge became much less in amount, and then the patient ceased to report; the fifth was not benefited. This series was made up, as far as possible, of cases in which the pathologic lesion was confined to the mucous membrane, not having yet reached the bone; the reasons for this will be stated later. The eczema in question was a chronic one, situated around the auricle, with often recurring acute attacks being superimposed on the chronic condition. The organism was isolated from a pustule, present during one of these acute attacks, with very satisfactory results. The peritonsillar case was one in which the abscess had been evacuated by surgical measures some months before, but the suppuration continued, becoming of the chronic variety, the cavity filling up with pus, discharging and again refilling. Two injections sufficed to clear up this condition. The abscess of the septum was also of this variety, essentially subacute or chronic, but one injection of 500 million was thoroughly effectual. With regard to the tonsillitis cases, some doubts were entertained as to the outcome of the treatment, as, on account of the variety of the bacteria generally making up the flora in the tonsil, the causal one might not be isolated. In the three cases in question, however, the staphylococcus was found in such numbers that it was undoubtedly the causal one. These were cases of chronic tonsillitis, with several acute attacks occurring each year. The treatment here was eminently successful. The chronic or subacute condition cleared up, and during the last winter the patients were entirely free from the acute attacks, this being the first winter in years that they had escaped.

Seven cases of pure streptococcus infection are reported, five being cases of postscarlatinal suppurating ears and two of chronic dacriocystitis. Four of the ear cases ceased discharging after varying periods, the fifth remaining the same. Both cases of dacriocystitis were discharged cured.

The next subdivision comprises three cases of infection with the gonococcus, the first being a very obstinate case of gonorrheal arthritis, which had resisted all forms of treatment. Cure was obtained very rapidly here, although the patient himself had given up all hope of ever being well again. The second was a case of chronic gonorrhea; here from an examination of the case, it was decided that the staphylococcus was playing more than a passive part in keeping the condition active; accordingly alternate injections of the latter and of the gonococcus were used, with thoroughly satisfactory results. The third case was one of conjunctivitis, complicated by ulcerative keratitis; the progress of the disease was quickly arrested, and I think the involvement of the cornea was hence much less.

Only one infection with the pneumococcus was under treatment, a case of seriginous ulcer of the cornea. In the scrapings from the cornea this organism was isolated in pure culture. This ulcer had been repeatedly curetted and cauterized to no avail, and then a vaccine was made. Immediately following the use of the vaccine the process started to subside and soon become quiescent. The treatment in this case certainly cut short the course of the disease and saved the balance of the cornea and, in all probability, the eye itself.

Friedländer's bacillus was found as the causal factor in three cases of chronic nasal catarrh. These were of that type in which constantly recurring acute exacerbations were added to the ever-present chronic condition. The improvement in all cases was marked; the chronic condition was much alleviated and the acute attacks could be easily aborted by one injection, given just as the attack was threatening. Here I have also placed three cases of chronic suppuration of the accessory cavities of the nose. These were of very long duration, years in all cases, and the organisms isolated were the bacillus of Friedländer, the streptococcus and the staphylococcus all being present in about equal numbers. As in the cases of chronic catarrh just mentioned, the first-named bacillus was



found as the causal factor, and as in many other nasal chambers examined this was found so constantly, it was arbitrarily assumed that this was the causal organism and that the other two organisms were accidental or secondary infections. Treatment was accordingly started on this assumption and pursued for some time. The nasal catarrh accompanying the sinus condition cleared up, just as in the cases of straight catarrh, but the sinus condition remained as before, and in the course of some few weeks or months the nasal chambers were reinfected from the sinus. These results, although rather unsatisfactory, are not discouraging, as very great relief was afforded for weeks at a time, and also because the test was a very rigid one, as will now be explained. In the first place, drainage was not secured by operation, and it was purposely endeavored to do without operation, trying to open up the natural passages according to the method of Wright, namely, irrigating the nose thoroughly and at frequent intervals with a solution of sodium citrate, to promote, if possible, the absorption of the occluding tissues. Nothing much was expected from this, but it was given a trial. Other reasons for failure lie in the fact that a very necessary, and, in fact, indispensable condition, may not have been complied with, that is, certainty as to the causal organism. In spite of these comparatively negative results I feel that under proper conditions, as to drainage and isolation of the proper pathogenic organism, this form of treatment will have a large share in the future in the treatment of such conditions.

The next series is also very instructive and interesting, but was not so disappointing, as favorable results were not really expected. It comprises seven cases of suppurating ears, in which the bacillus pyocyaneus was isolated, and which were treated with a vaccine of this, with negative results in all seven cases. Doubts were entertained from the start, on account of the well-known cultural and pathogenic characteristics of this bacillus, it being one of low pathogenic power, at least for man, generally existing as a parasite, not being the primary invading organism, but a secondary one. Moreover, this bacillus does not rightly belong to the class of organisms producing endotoxins, as the ordinary pyogenic bacteria do, but, on the other hand, it produces a soluble diffusible toxin, pyocyanin, which is easily visible to the naked eye in a culture a



few days old. Such an organism would probably therefore call for an antitoxin, like diphtheria, and not a vaccine. In spite of all these factors, however, as this bacillus has been found by others as the only organism in several fatal cases of septicemia, and as it is probably more often a primary factor than is thought, a vaccine was made in each case and used. The results were negative, as above stated. Having in view this fact, it was decided to displace, if possible, this bacillus and to replace it by another parasite of practically no pathogenic action and having no effect on the tissues, as suggested by Metchnikof and North. A series of cases are now being kept under observation and are being treated by a solution or culture of the bacillus *Bulgaricus*, commonly sold under the name of Massolin. The results, so far, have been very encouraging, but the number of cases treated is too small to judge from. Further reports of this investigation will be made in the near future by Dr. Haskin.

Two cases of rhinoscleroma, infection with the bacillus of Frisch, have been under treatment for the last two years or so, and one is still receiving injections. These are the cases reported last year by Dr. Guntzer and are the first to be treated in this way, so far as is known. Considering the disadvantages we were under in the treatment of these cases, having no precedent to guide us in the dosage and other factors, the results have been encouraging. Cure has not been effected, but the improvement has been marked, and the patients, instead of being confined as hospital cases, are able to pursue their ordinary vocations in life. One of the patients, in whom it was necessary to do a tracheotomy, has now gone for months without the tube, and his breathing is better than it has been in years. He left recently to take a position in a city in the West.

In comparison with the other methods of treatment recognized as applicable to this condition, such as extensive operation, the X-ray and the use of radium, I think the balance is in favor of the vaccine, if an opinion based on such a small number of cases treated has any value. However, in view of the poor results obtained by any kind of treatment in this slow, obstinate and comparatively unknown disease, and as the causal bacillus can be so easily grown, treatment by vaccine would seem to be thoroughly rational and would perhaps do

more, if our experience were larger. Since the treatment was begun the progress of the disease had been stopped in both cases.

There were three cases of infection with *bacillus catarrhalis*, and with these will be considered three other cases giving the same clinical symptoms, those of acute nasal catarrh, present in that class of patients who are always "catching cold." In the latter three the causal bacillus, although easily isolated, could not be classified by name. All cases yielded to treatment; the attacks became less frequent in number and severity, and when an attack threatened, an injection was efficacious in limiting the duration to less than one day. Some of these patients, who used to have a cold or series of colds every winter, have since been free.

Under the name of unknown species of bacteria I have grouped the last three in the series mentioned above, and in addition four cases of chronic suppurating ears and two cases of chronic dacriocystitis. In these cases, the organism isolated was undoubtedly the causal one, but did not fall under any species with which I am familiar. Three of the ear cases cleared up, but the fourth remained as before. The two cases of dacriocystitis were entirely cured.

This completes the list of cases treated. On the whole, I think the results were very satisfactory. It might here be said that all the ordinary methods of accepted or recognized treatment were used in conjunction with the vaccine treatment. Personal hygiene was rigidly insisted on, and in the ear cases local irrigations were kept up. However, in view of the fact that these methods of treatment had been given a thorough and exhaustive trial, in some cases extending over a period of years and in all cases at least for weeks, before the vaccine was used, the results obtained can be fairly attributed to the vaccine treatment.

Some stress was laid on the fact that the choice of ear cases was limited to those in which it was thought the lesion was limited to the mucous membrane. This was in reality a wholly unnecessary proceeding, being due entirely to personal reasons, as the time that could be devoted to this investigation was limited, and it was necessary to get quick results, because the majority of cases treated were outdoor cases, and as these patients cannot be expected to come over a long period of time,

as is invariably the case, they are one by one lost sight of. A few words might be said about that larger proportion of chronic suppurating ears, in which bone necrosis is probably present. Considering, in brief, the pathology presented to us in such an ear, we have progressive necrosis of bone up to the point at which the resisting powers of the body are strong enough to stop the advance of the necrosis, that is, we have a line of demarcation formed, just as in the death of the soft tissues or gangrene. The necrosed bone is a foreign body and must be removed. Nature eventually accomplishes this by a slow process of ulceration, taking months to remove it. If the mass is of considerable size, the surgeon can remove this in a few minutes, provided he can do a thorough operation, removing the bone not only macroscopically but microscopically diseased. A consideration of the radical operation shows that the majority of the results attained are not satisfactory, in many cases the suppuration continuing and the after-treatment lasting from at least a few months in the most favorable cases to a lifetime in others. Of course, there are certain cases that must and always will demand the radical operation, but lately the pendulum has swung back, and the radical operation is not being done on every case that presents itself. Any measure, therefore, that offers at least a chance of success ought to be given a trial. If the causal organism is isolated and the vaccine treatment tried, nature will be stimulated to form the line of demarcation. The time of treatment will extend over a long period, but even now all forms of treatment of this condition demand months of treatment. It is hoped that a further report on a series of such cases will be made as soon as a sufficient number have been observed.

The Hiss extract of leucocytes was used in nine cases. This was in reality six cases, as the other three were cases that were not suitable to this form of treatment. Of the six cases, four recovered, and two died. It will be interesting to give in some detail the history of some of these.

It must be borne in mind that all these cases were ones in which all other measures of treatment had been exhausted, and as a last resort the extract was used, the surgeon in charge of the case feeling that it did not matter much what was done, as the case would terminate fatally. A severer test could not be devised, and the results were all the more encouraging be-



cause of this fact. The most satisfactory was a case of pansinusitis. G. H., age 9 years, was operated on, a frontal sinus operation being performed, the anterior ethmoidal cells being removed at the same time. For fifteen days following the operation, the temperature ranged between 98° and 105° F., as shown on the accompanying chart. A diagnosis of meningitis was made by Dr. Zabriskie, who found marked general hyperesthesia, deep muscular tenderness and a well-marked Kernig's sign. The smear from the frontal sinus showed mixed infection, with streptococcus predominating. Just before the extract was injected, the temperature was 104.4°, pulse 145, respiration 30. Within twenty-four hours the temperature fell to 100°, pulse to 90 and respirations to 25. The temperature then gradually returned to normal and recovery was uneventful.

The second case was one of mastoiditis and sinus thrombosis, with a general bacteremia, as shown by the blood culture, long chained streptococcus being found in the latter. The simple mastoid operation had been performed, and the patient had been discharged from the hospital and was attending the out-clinic. On one of the occasions on which he presented himself, he had some fever and was not feeling well. He was admitted to the hospital for observation, and after seven days, during which his temperature varied between 102° and 104°, a blood culture showed long chained streptococcus. Operation was immediately performed and a large clot was found in the lateral sinus. Free bleeding was obtained from the torcular end of the sinus, but rather poor from the jugular end. As the patient was in bad condition, an intravenous infusion having to be given on the table, it was decided not to take out the jugular. The temperature remained down for twenty-four hours, but at the expiration of this period again arose and assumed the septic type. The Hiss extract was then started, and the improvement in the general condition was immediately marked, although the effect on the temperature was not so noticeable. As soon, however, as visitors were forbidden entrance, the temperature returned promptly to normal. Here it may be noted that the jugular was not excised, the clot simply being cleaned out as thoroughly as possible.

The third case of this series was also one of mastoiditis, complicated by sinus thrombosis. At the time of operation, the



lateral sinus was found thrombosed and filled with a very foul-smelling pus. The jugular was accordingly excised. Following operation, the temperature gradually rose, each day's record being a little higher than the preceding day. Physical examination on the fifth day following operation revealed symptoms of early meningitis, the patient also being unconscious and delirious. Immediately following this examination the Hiss extract of leucocytes was given at regular intervals of twelve hours, and the improvement was marked from the very beginning of the treatment. The temperature gradually fell, and the great improvement in the general condition of the patient was most marked, the symptoms of the toxemia gradually disappeared, the delirium disappeared within a few hours, and the patient was perfectly rational in twenty-four hours. Three days after the beginning of the treatment the temperature had reached normal and thereafter the recovery was uneventful.

The fourth case was one of mastoiditis, complicated later by sinus thrombosis and lobar pneumonia and pleurisy. This was the first case to be treated by the extract, and the patient was in a practically moribund condition when the extract was given. The history is as follows, and the accompanying chart shows the course of the temperature: Four days after a minor nasal operation the patient developed an acute infection of the left middle ear, also mastoiditis and eventually came to operation, a simple mastoidectomy being done. Following operation the temperature was of the septic type, as shown on the accompanying chart, and on the fifth day the patient had a decided chill. The next day a second operation was decided on, and an exploratory incision in the lateral sinus showed the presence of a large clot. This was removed and the jugular vein excised. The temperature continued to be of the septic type, and on the second day following the last operation pneumonia and pleurisy developed. The patient was in extremis, and at this time the Hiss extract was given. Improvement was noted after the second dose, and although the extract was given at very irregular intervals convalescence was uninterrupted.

The next two cases are the ones that progressed to a fatal termination. The first was a child, one and one-half years old, and was operated on for acute mastoiditis, the usual simple mastoidectomy being done. The patient was in bad condition,

a large subperiosteal abscess being present. Temperature on admission was  $101^{\circ}$ ; immediate operation was done, and following the operation the temperature gradually rose, reaching  $105^{\circ}$  on the fourth day and  $106.5^{\circ}$  on the eighth day. The diagnosis was uncertain, as there were very few physical signs to go by. On this day, however, well marked opisthotonos was present, and a second operation was performed, the dura being found congested and bulging. This was incised, and the temporosphenoidal lobe probed in various directions. Immediately following the operation the Hiss extract was injected, and, although the case finally resulted fatally, the child lived for thirty-six hours, with a temperature of over  $107^{\circ}$ , something, I think, quite remarkable, considering the condition. On the day following the second operation, lumbar puncture revealed the presence of a small extracellular diplococcus in the spinal fluid. This was one of those obscure cases in which a diagnosis could not be made until late and, considering the remarkable vitality of the child, an early use of the extract might have accomplished something, just as in the first case reported.

The other fatal case was also of this type. A man 37 years of age was operated on for acute mastoiditis, and the usual simple operation was done. Following operation the temperature did not come down, but continued to rise gradually, reaching  $105^{\circ}$ , and symptoms of meningitis gradually developed, accompanied by repeated chills. Secondary operation was resorted to, and the sinus was found thrombosed and a well-marked meningitis, the dura of the middle fossa being injected and bulging. This was incised and a drain inserted in between the dura and brain tissue; the jugular was then excised. For the following two days the temperature fluctuated and gradually rose to  $105^{\circ}$ , pulse 154 and respirations 52. It was at this point, when the patient was taking the final change for the worse, that the extract was injected, but it was of no avail, and the patient succumbed in a couple of hours. This case is placed here because it was a suitable one for such treatment, but it is not a fair one to count for the extract, although in some of the other cases the condition seemed almost as hopeless. The other three cases, which were not suitable cases for this treatment, were the following: The first was a case of brain abscess, but the real cause of death was a very acute

parenchymatous nephritis with uremia, a disease altogether outside of the sphere of useful treatment by leucocyte extract. The second was a case of specific frontal sinusitis, on which multiple operations had been performed. Each of these cases received only one injection, when the nature of the lesion was recognized and treatment stopped. The third case was one in which the diagnosis was in doubt and was probably not an infection at all, but some intestinal disorder.

On the whole, therefore, I am more than satisfied as to the efficacy of the extract and am absolutely convinced that otherwise a fatal issue was inevitable in the above cases and that this was avoided by the extract. To get results in any disease treatment must be started early, especially in such a disease as meningitis, where such a delicate mechanism as the nervous system is attacked. Once it gains a firm hold, it is a hard matter to do anything.

A few words will not be out of place concerning the reliability of the opsonic index and its calculation. Lately some prominent authorities have reported that they found it unreliable, in not agreeing with the clinical symptoms and also in that the calculations taken from the same cases at the same time by different observers have differed quite markedly from each other. Granted that these statements are true, and they assuredly are true, in my experience, are they cogent reasons why we should condemn the opsonic index as unreliable and bring it into disfavor? Consider the practically parallel proceeding in making a blood count. Does the result of the blood count always agree with the clinical symptoms? Do any two men get the same results when blood counts are made on the same case under identical conditions? You can all answer the first question. Who among you has not had a case in which the clinical symptoms and the blood findings showed absolutely no correspondence, yet this fact did not induce you to condemn the blood count as utterly useless. You know that in the majority of cases it is reliable. The same is true about the opsonic index. Why, then, condemn this? The reason for failure in some cases, perhaps in the majority, is that it is mainly a question of the personal equation, that factor which we cannot get rid of. The results of a blood count lie practically in the hands of the one making it, and if he is conscientious and follows the technic his results are to be depended on,



but if he is not conscientious and looks upon this as an unwelcome piece of work, to be done with as soon as possible, then it were better for you that you had done without this aid to making a diagnosis. The same applies to urinalysis or any laboratory work. That is one of the reasons why I make the plea that this opsonic work be left in the hands of those who are capable of doing it. The chances of error in the calculation of the opsonic index are far greater than those in doing a blood count, as the technic is more complicated and, unless the smallest details are worked out and the whole technic is rigidly adhered to, the results will vary. The reason why Wright and his immediate followers got such satisfactory results was because they were scrupulous in this regard. The results of such an authority as Hektoen, in this country, ought to carry some weight. In a series of acute infections, independent calculations were made by himself and four others, under exactly the same conditions, and it was found that these calculations tallied, all showing the negative phase, and then the positive phase, and as the index rose the symptoms subsided. Hektoen further states that when properly and conscientiously performed, it is quite reliable in the majority of cases, and is, in fact, an indispensable aid. I have found it so in my experience.

I now come to the scientific side of the question and will briefly consider at the beginning some necessary facts that must be stated in order to understand what is to follow. The old ways of treating infections were tonic and supportive, obviously unsatisfactory, as they did not try to get at the cause of the disease. Now, by a study of nature's own methods of defense, as seen in infections artificially produced in animals, we endeavor to imitate her and to make use of the same weapons. This is the keystone of vaccine and serumtherapy; it is around this pivot that everything revolves. In any disease we have two factors to consider; on the one hand, the invading organisms; on the other, the resisting forces of the body. Analyzing shortly the first, we find that all bacteria do not act on the body in the same way, that, in fact, their methods of attack differ widely from each other. They all have a common action in the sense that they act mechanically, just like any other foreign body introduced into the body, that is, they act by their physical presence. This is a comparatively unimportant point, its only importance practically lying in the fact that



it may lead to embolism in the vessels. The vital ways in which the bacteria act may be divided practically into two classes. In the first class we have those bacteria which secrete soluble, diffusible bodies in the media in which they thrive, called toxins. These toxins are readily given up to the circulating fluids of the body, and it is through the agency of these toxins that the bacteria produce their baneful effects on the body. The second class, and this is the important one for us to consider, as to it belong the organisms which we have been considering above, comprises that class which elaborate within their own bodies a class of substances known as endotoxins. These endotoxins are retained within the bacteria elaborating them, not being given up to the culture media or the circulating fluids, but only being set free when the bacteria are dead or dying. It is probable that some species of bacteria act in both ways, by a soluble toxin and by an endotoxin. To this class the tubercle bacillus probably belongs, the active toxin being an endotoxin and the soluble one being an accessory one. It was to combat this latter, the soluble one, that Koch introduced his old tuberculin, and, since the real toxin is thought to be the endotoxin, the reasons for failure of the old tuberculin are apparent.

On the other hand, we have to consider Nature's ways of fighting these bacteria. When a foreign substance is introduced into the body, especially if that foreign substance is of an albuminous nature, the system, by the very presence of this material, is stimulated to the formation of what are known as antibodies, that is, bodies whose function it is to neutralize the effects of or destroy the substance introduced. Obviously these antibodies may be of many different varieties, depending on the character of the antigen calling for their formation. Applying this principle to the bacteria forming the soluble toxin, we will have the formation of an antitoxin. The examples of this class are perhaps the most familiar to us, diphtheria antitoxin and tetanus antitoxin being of this nature. Against the second class we would have the formation of bactericidal and bacteriolytic bodies, which would destroy and dissolve the bacteria, setting free the contained endotoxin. It is important to emphasize at this point that when the bacteria are destroyed and dissolved by the foregoing serums the endotoxin is not necessarily neutralized, in fact, is not generally so. This point

will again come up in the discussion of these serums. Lastly, under the heading of defense, we must consider an important factor, the phagocytes themselves. The question of the origin of the antibodies, whether they are derived from the phagocytes, as Metchnikoff holds, or from other sources, as other well-known investigators claim, is entirely outside the scope of this short paper, but whatever view we hold, we must all admit the great importance of the phagocytes themselves. Since the action of the opsonins is intimately bound up with that of the phagocytes, these will also be classed here. It may be well to define exactly what opsonins are. The name is from the Greek, and freely translated, means, "to prepare for eating," or "I prepare for eating." The opsonins are normally present in the blood serum, and, as the name implies, they act on the bacteria in some way, preparing them for ingestion by the phagocytes, that is, they prepare them so that the phagocytes can more easily eat and digest them. Hence, indirectly, they act by stimulating the phagocytes and hence the placing of these two factors together.

Based on the preceding ways in which nature copes with infection, we have four classes of therapeutic agents, each one differing from the other in the fundamental, underlying principles of application. These four comprise the antitoxins, vaccines, bactericidal and bacteriolytic serums and the leucocyte extracts. It is not necessary to deal with the antitoxins, as their use is well known. The second class, the vaccines, are one of the important subdivisions to be dealt with at some length. By the use of vaccines, either attenuated cultures of the living bacteria or, as is now more often the case, killed cultures, we aim to stimulate the body to increase its formation of antibodies and thus to overcome the infection. The point to be emphasized here is that the body itself must form its own antibodies, that is, an active immunity must be brought about. The significance and great importance of this statement lies in the fact that it takes some time for this immunity to be developed; it is not a matter of hours or of a day, but several days, generally three to four at least, and sometimes much longer. During this period, in which the antibodies are being formed and consequently immunity is being developed, it is a well-established fact that the resisting powers of the body are not only not increased, but are actually diminished

in the large majority of cases. This is the so-called negative phase and is a very important factor to be remembered. This phase can easily be shown on the chart of an opsonic curve, where, following an injection, we have a decided fall in the curve and, after a varying period, depending on the dose and other factors, a rise to a point higher than the previous reading. A practical, everyday example, probably not an exactly parallel one, is the Widal reaction in typhoid fever. Here we do not get the agglutinating action of the serum, the evidence of antibody formation, for several days after the clinical symptoms of the fever have appeared; when reaction has well set in, we get it. I will illustrate this point further by reverting to the case of intestinal tuberculosis which ended fatally. This case was running a temperature of about 101° F., and all the symptoms of a systemic intoxication were present. This case was decidedly not a suitable case for such treatment. Take, for example, a systemic acute infection, such as a case of acute septicemia, in which we have high temperature and all the symptoms of a grave constitutional intoxication. If it were put to a vote of clinicians as to whether they would use a vaccine in such a case, I have no doubt whatever that many might favor such a course, and yet nothing is more illogical and nothing could be more harmful. Consider the state of affairs present in just such a case; interpret the symptoms. The train of symptoms or the bacteremia is simply the way the body has of showing that it is being hard pressed, and as the symptoms increase in severity the lines of defense are being broken down; that it is being defeated in the struggle, that its poor, worn out, jaded cells have exhausted their powers of antibody formation. How unfortunate, then, to use a vaccine in such a case, calling upon the cells to form more antibodies when they are already exhausted. Following this injection for several days, we find the body more open to infection, it being in the condition spoken of above as the negative phase. Yet this is being done every day, especially in the treatment of tuberculous patients, simply by the clinician not knowing or not realizing the nonsuitability of the case for this treatment. It is an absolutely different consideration, when the case is subacute or chronic. Here a rational and closely watched course of treatment with the vaccine is of almost specific value in some cases. The above considerations apply to constitu-



tionally acute cases, in contradistinction to the locally acute cases, as these latter were the classes of cases that were markedly benefited.

The next point in a consideration of vaccines is the kind of vaccine to be used, that is, whether autogenous, that cultivated from the patient, or a stock vaccine. To my mind, there are no two sides to this question, as in all cases it should be an autogenous vaccine, although I have used the stock one in some few cases. The vaccine, as explained above, stimulates the formation of antibodies and opsonins, and so far experience seems to show that these antibodies and opsonins are specific, that is, that a certain bacterium will give rise to a certain antibody or a certain opsonin, and that antibody or opsonin will be effectual against that bacterium and against that alone. It is easy to see, then, why we should use an autogenous vaccine. The stock vaccines are made up of mixtures of different strains of bacteria of the same or allied species. If a strain of the particular offending organism is present, we may get results, but if it is not present, then the specific antibody or the opsonin is not stimulated to formation, and no good results from its use. The system, with a stock vaccine, is called upon to form a whole series of antibodies, corresponding to the varieties introduced, and these have no function to fulfill, as there are no corresponding bacteria to oppose, so that the energy of the system is spent in useless work. The energy is not a trifling force, to be thus dissipated. This observation applies to all stock vaccines, but especially to vaccines of bacteria, such as the staphylococcus and the streptococcus. When we consider the multiplicity of forms of such bacteria, it is easy to see why stock vaccines fail in some cases, in which the results with autogenous vaccines have been so brilliant. We are all familiar with the many varieties of streptococcus, differing as they do so little in morphology and staining properties, and, what is more important, so much in their pathogenic action. In some work in which I am now engaged, in classifying the various bacteria found in the tonsils, one is at once impressed by the many varieties of streptococcus isolated. When we consider the staphylococcus, the same holds true. We see differences in pathogenicity, pigment formation, liquefaction of gelatin and their cultural characteristics in general. These are but examples; the list is almost endless. Thus we can understand



that in a given case, unless the invading organism forms one of the strains in a stock vaccine, probably no effect is produced. Again, why do we need stock vaccines at all? Needless to say, the microbial cause of a disease must be known before a rational attempt can be made to treat with a vaccine. If we can get enough of the discharge to make a bacteriologic examination, we can at the same time make cultures and prepare a vaccine. In the above series of cases a stock vaccine was used in treating some of the cases of tubercle infection, on account of the difficulty of preparing this vaccine, but just as soon as possible, an autogenous vaccine was substituted; also, in one case of tubercular adenitis, which did not improve under the human tuberculin, bovine tuberculin was substituted and this was of necessity nonautogenous. The gonococcus is rather hard to prepare as a vaccine, on account of the fastidiousness of this bacterium, which grows only on special media and quickly dies out. As there are probably few varieties, the results with the stock vaccine have been rather good, but in all cases it is better to use the autogenous one. The stock ones may not be fresh, and this is quite an important point, as, even with autogenous ones, it is better to make new vaccines every few weeks.

The third class of agents comprise the bactericidal and bacteriolytic serums. For the production of these, just as in the formation or preparation of antitoxin, we immunize animals, such as the horse, against the pathogenic organism. The serum of such animals is now used for injection into patients suffering from infection with that organism; in other words, we get the cells of the animal to manufacture the antibodies and then use these bodies, ready made, so to speak, for injection into patients. Thus, in this class, it is a passive acquired immunity that is brought about, the cells of the patient taking no part in the process. This would be an ideal condition of affairs, supplying the body with its weapons ready for use, but unfortunately the practical results have not been encouraging. Mainly for this reason and also because the theoretic considerations are, on the whole, opposed to such serums, I have not used them. One point, and this seems to be more than theoretically established, is the fact that a bactericidal serum is not necessarily and in fact is not generally antiendotoxic; that is, that, although the bacteria are killed, the contained

endotoxin is not neutralized but is actually set free as a poisonous body having free rein to act injuriously on the body. Therefore, when an injection of such a serum is given, so much endotoxin may be set free that the body succumbs to the severity of the infection. The question of anaphylaxis also comes into question here. The action of such serums may be utilized either as prophylactics or as curative agents. The first does not interest us practically, as most of our cases are well advanced when we are called to treat them, and hence are not subjects for prophylactic measures, and as curative agents they have proven failures. Lately, the so-called polyvalent serum against streptococcus infections is being again brought into use. This is made by immunizing suitable animals against a number of strains of streptococcus and using the serum of such animals in man. Now, in the immunity developed after a streptococcus infection, the serum does not possess any marked bactericidal or antitoxic properties, but rather acts by stimulating phagocytosis or more probably by supplying opsonins. Many have claimed that it has not only protective properties but also curative ones. It probably has some action in supplying opsonins, but it is open to all the objections cited against bactericidal serums in general and in addition lacks one very necessary quality, that of specificity, it really being on the order of the old gunshot prescription, empiricism as opposed to rationalism.

The next subdivision deals with the leucocyte extracts and the rationale of the Hiss extract is based on the all importance of the leucocytes in the struggle against infection. If we consider the phenomena presented to us in inflammation, we are at once impressed by the important role which the leucocytes assume and their importance in the fight waged against the invading army. Soon after the infection is set up, we have a vast army of leucocytes or, as they are now better known, phagocytes, hurrying to the point of attack and actively combating the bacteria. This is true of the infections in general, and especially so in the infections which we are ordinarily called upon to treat. In the struggle that ensues many of the phagocytes are killed, others are maimed or injured and all are more or less worn out. If the bacteria are the stronger the body is overwhelmed; if the phagocytes, the infection is overcome and the body returns to the normal. All the differ-

ent leucocytes are not equally important, the main ones concerned in the majority of infections being the polynuclear neutrophiles and the large mononuclear leucocytes. It follows then logically from the above, that if we can assist or strengthen the leucocytes in any way, we will at the same time enhance the chances of the body overcoming the infection. Hiss divides the protecting factors involved into two classes; in the first he places the antibodies, such as the agglutinins, lysins, opsonins, etc. These are readily produced by the cells and given up to the circulating fluids of the body. In the second class he placed the endobodies of the leucocytes. He assumes that these endobodies are present in the bodies of the leucocytes elaborating them and are not, as a rule, given up to the circulating fluids, as the first set were, but are retained in the bodies of the phagocytes manufacturing them, serving to protect them, and, in this indirect way, also protecting the more highly specialized cells. Therefore, if we furnish to the phagocytes the bodies of which they are deprived in the fight, that is, furnish them quickly and directly with their weapons of warfare, they would be the better protected from destruction and would be in better condition to carry on their work of ingesting the bacteria and would the better be able to recuperate quickly. With this end in view, Hiss proceeded to make an extract of rabbit's leucocytes, hoping that it would contain the above bodies and that by the injection of this extract into patients the victims of infections, the phagocytes would thus be strengthened. For several reasons, preference was given to extracts rather than to the intact leucocytes, as the former are the more diffusible and would thus be carried very quickly to the affected parts, protecting not only the leucocytes, but also the more highly specialized cells. Also, bearing in mind the probable specificity of opsonins, the intact leucocytes of a foreign animal, such as the rabbit, may not find in the serum of man the necessary opsonins for their stimulation and activation, or the opsonins may be depleted by the disease. Moreover, experiments were carried out with such leucocytes with practically no results. An extract is independent of these considerations. The results of experiments in animals, and of treatment of infections in man, has apparently borne out the truth of this assumption. Analyzing the results, it would seem that this extract does not act through any bactericidal, bacteriolytic



or phagocytosis-stimulating power, but that its very marked favorable influence on the temperature, and especially on the general condition, is in all probability referable to its neutralization of the toxic products, that is, ordinarily speaking, to its action in combating the condition which we describe as sepsis or toxemia.

Such being the principles on which it acts, we can see the advantages of such an extract. In the first place, we inject only substances which are normally present in the body. The reaction, therefore, following the injection, is practically negligible, only a very slight reaction being present in some cases, and these were few. Secondly, the body is not called upon to expend any of its energy in the developing of an immunity, that is, to form antibodies. This is an important factor, as was shown in the discussion of vaccines. Another factor, and this is probably the most important one, is that the effects of the extract are immediately felt, within a few minutes after injection, or at most within a few hours. The advantage of this in an acute case is apparent. Although given in doses of 10 cc., it is very quickly absorbed. There are some few disadvantages. We have no methods of standardizing, and of necessity, therefore, the extracts, made at different times and from different animals, must vary. This objection does not amount to anything practically, as the bodies in the extract are normally present in the body, and an increase does not do any harm, the excess being all to the good. Again, we are at sea regarding the length of time of its action, and also the proper dose. These also are not important practically, as we can guard our injections by the clinical symptoms. Some of the other great advantages are that we do not have to isolate the offending organism, as the action of this extract is absolutely independent of the bacteria, depending only on the resisting powers of the body. The great importance of this statement will be appreciated when the treatment of some of those obscure cases of sepsis comes up, in which the causal factor cannot be isolated, but which are surely due to some invading organism, or, in cases of mixed infection, when we are in doubt as to the primary organism, as in the meningitis case reported.

Incidentally, I might here mention that Dr. Adrian Lambert reported recently a series of cases which interests us, as we occasionally have to deal with erysipelas, complicating mas-



toid and other operations. He reports 51 cases of erysipelas of all kinds, treated on his service at Bellevue Hospital with the Hiss extract. In cases so treated within forty-eight hours of the onset, the extract acts almost like a specific, the temperature dropping almost to normal, the attack being thus cut short. In all cases the symptoms were much alleviated, temperature lowered, nausea and vomiting stopped and the complications and sequelæ were of much less frequency. In cases treated late, the succeeding septicemia was in many cases aborted. Some interesting statistics are furnished in cases of erysipelas in infants under one year of age. Before the use of the serum, his mortality rate was 100%. Out of six cases treated with the extract, four survived, or over 66%, a great difference surely.

Briefly recapitulated, then, the conclusions to be deduced from my own work are these:

1. In acute constitutional diseases, such as pyemia, septicemia and sapremia, the vaccines are contraindicated. In such cases, the leucocyte extract finds its greatest field of usefulness and will often save cases which are apparently hopeless. Some authorities do use vaccines in such cases, with the admonition to avoid the negative phase by proper dosage and very guarded administration. This sounds easy, but it is an entirely different matter to apply such to a case. Therefore use the extract of leucocytes in such cases and avoid vaccines calling for active immunization.

2. In the locally acute, without systemic symptoms, subacute and chronic cases, the vaccines find their greatest field of usefulness and will be found to act almost as specifics. I have had no experience with the leucocyte extracts in such cases, but they should be effective, especially in the subacute and the locally acute and certain types of chronic cases, in which the diseased focus is not walled off by a firm, hard, fibrous wall. However, the results have been so good with the vaccines that I have not felt the necessity of using any other agent.

3. In all cases use autogenous vaccines in preference to stock ones, as the results will be better and surer, and the administrator knows exactly what he is administering.

4. Make fresh vaccines frequently, so as to ensure their greatest potency.

5. Be guided in the administration by the clinical symptoms,

but at the same time do not neglect to calculate the opsonic index. In the majority of cases it is just as reliable as a blood count is.

6. Do not use tuberculin in tuberculosis when general constitutional symptoms are present, that is, when the patient is in the pyrexial stage. First, localize the process as much as possible, and then start the treatment, interrupting it if the condition again becomes general.

7. Give small doses often repeated, rather than large doses seldom repeated. In all cases start in with a minimal dose and then increase it.

8. Always have in view, even in the simplest case, the danger of anaphylaxis or hypersensitization. This is no negligible quantity.

9. Always combine with the vaccine treatment the other general medicinal and hygienic measures. This vaccine therapy is not a cure-all.

10. If you have a case of septicemia, such as that which follows sinus thrombosis, and your surgical measures have been exhausted, do not wait until the patient is in extremis or moribund, but start the use of the extract early, so as to give your patient the best chance. The extract is not a miracle worker. Most of the cases of the series reported to-night were very far gone and were really in the final stage. A more severe test of the efficacy of an agent would not have been devised.

Serum and vaccine therapy do not comprise agents which can be doled out by a certain dose, such as a general medicine, but it absolutely demands, for its intelligent administration, a certain degree of knowledge and skill which cannot be acquired outside of a laboratory. Also, out of justice to the patient, who in good faith trusts himself for treatment into our hands, fair play demands that we should do our best by him. Hence the average man, unskilled in this way, should recognize his limitations and avoid the possibility of doing harm and of bringing such an important therapeutic measure into disrepute. On the other hand, these agents should be given a fair trial and should no longer be neglected, as they have been in the past, by the specialist in his special fields.

In conclusion, I wish to state that the major part of this work was carried on in the laboratory of the Manhattan Eye, Ear and Throat Hospital, New York City, and in this connection I

wish to express my appreciation of the many kindnesses of Dr. Jonathan Wright, the director of the laboratory and instigator of this line of investigation; of Dr. E. G. Zabriskie, the pathologist, and of Mr. S. Richardson, the laboratory assistant. I also wish to extend my thanks to the surgeons and assistant surgeons of the above institution, who gave me the opportunities of treating their cases. My sincere thanks are also due to Drs. W. T. Connell and William Gibson, of Queen's Medical College, Kingston, Canada, my Alma Mater, who instructed me in the technical methods of vaccine preparation, and the latter of whom placed his case records at my disposal for reference. Dr. J. H. Güntzer was a co-worker with me, especially on the cases of rhinoscleroma, and my thanks are also due to him. To Dr. Philip Hanson Hiss, Jr., professor of bacteriology in the College of Physicians and Surgeons, Columbia University, New York, my sincere thanks are hereby extended for his uniform kindness and courtesy to me during the investigation and treatment of the series of cases with his leucocyte extract. Lastly, I wish to express, as far as words will allow, my keen appreciation of the many kindnesses of my associate, Dr. William Henry Haskin, whose kindly sympathy and encouragement provided a constant stimulus to me in the prosecution and continuance of this work and in the preparation of this report.

11 East 48th Street.

## NEW YORK ACADEMY OF MEDICINE.

### SECTION ON OTOTOLOGY.

*Meeting of November 12, 1909.*

DR. ROBERT LEWIS, CHAIRMAN.

#### PRESENTATION OF PATIENTS.

##### **A Case of Sinus Thrombosis With Some Unusual Features.**

DR. SEYMOUR OPPENHEIMER. J. G., aged 14, was admitted to the medical service of Mt. Sinai Hospital, May 31, 1909, with the following history: Two months ago had pain in the left ear; the drum membrane was incised, and a discharge took place, which persisted for four weeks. Since then has had severe occipital headaches. Following the cessation of the discharge, there was some temperature, and the patient felt chilly; at times distinct chills, followed by sweating. The chills occurred at very irregular intervals, sometimes as frequently as five a day, or again skipping a day. Vomiting nearly every day. For the last few days, pains in the joints of the middle finger of the left hand and severe pains in the left hip. Slight stiffness of the neck. Ocular examination showed the veins tortuous and a blurring of the edges of the disks—a beginning optic neuritis. The patient was much emaciated. Slight prominence behind the jaw of the left side, beneath the tip of the mastoid; no mastoid tenderness, nor any tenderness along the course of the neck; no discharge from the ear, but the drum membrane was dull and thickened; the canal wall possibly slightly infiltrated. A soft flowing pulmonic murmur is present. Cervical and axillary glands enlarged; liver enlarged. Metacarpal phalangeal articulation of the third finger tender and swollen. Motion of the limb causes pain in the left hip. Temperature 101.5°, having fluctuated only within a degree since admission. White blood count, 21,000; polynuclear count, 76 per cent. Patient regarded in the medical service as a typhoid suspect.

June 1st. Blood culture; large quantities of streptococci present. Following the report of the blood culture, patient was transferred to the ear service.



June 2nd. In view of the significance of the positive blood culture, and the previous history of otitic disease, the mastoid process was opened and the sigmoid sinus exposed. Small quantities of granulation tissue were found in the mastoid, the process being pneumatic in structure. The routine operation was performed. On opening the cells posteriorly some pus escaped from a perisinus abscess, the sinus being placed rather far forward and superficial. The contents of the sinus consisted of a broken down purulent thrombus, apparently not of recent origin. This thrombus extended almost to the torcular, necessitating the removal of a large area of bone in that direction, in order to establish free bleeding. The external wall of the sinus was entirely removed; the bulbar end of the sinus contained a purulent thrombus, which was cleansed out and a catheter drain inserted. The jugular vein was ligated and excised prior to the manipulations upon the sigmoid sinus. The distal end of the jugular vein was brought out into the neck wound, and a catheter drain inserted here as well. The condition of the patient was very grave upon the operating table, necessitating intravenous infusion. For a week following the operation the temperatures remained very high, and there was a development of metastatic processes in the left hip, shoulder joint, and finger, which, under appropriate treatment, subsided. Recovery from this time on was uneventful.

Culture of the pus from the sinus showed streptococci as well as the tissue of the vessel wall and the thrombus itself. Blood culture taken the day after the operation was negative. The interesting features of the case are the development of an acute tympanic process, which apparently cleared up in the middle ear and yet was invading the sigmoid sinus. This case shows again the importance of the positive blood culture in otitic disease, for although the patient showed the symptoms of a marked septic process prior to admission to the hospital, the medical attendants in no way regarded it as associated with the aural disease, in view of the absence of discharge from the ear.

DR. RAE inquired whether he was correct in understanding Dr. Oppenheimer to say that it was the routine treatment in Mt. Sinai Hospital to ligate the jugular before doing the mastoid operation.

DR. OPPENHEIMER replied that in about 90% of the cases

that showed a positive blood culture, where it was not done primarily, it was found necessary subsequently, and it is now his custom to perform it primarily, where the previous clinical history has been of some duration and of much severity, and where metastatic signs are present.

DR. RAE could not approve of the wisdom of this proceeding. The records of the Manhattan Eye, Ear and Throat Hospital showed several cases in which the blood culture was positive, but in which the clinical evidence of sinus thrombosis was absent, and which went on to perfect recovery after simple mastoid operation.

In addition, a positive blood culture does not necessarily indicate the presence of an occluding clot in the sinus. A limited number of these cases recover after opening the sinus and removing a parietal clot.

Lastly it will not be denied that profound shock follows the ligation and resection of the jugular. It therefore seems extremely injudicious to first ligate the jugular and then prolong the anesthesia while the mastoid operation is performed.

For these and other reasons, Dr. Rae is of opinion that, even with all the clinical evidence of sinus thrombosis, including a positive blood culture, it is fairer to the patient first to perform the mastoid operation, satisfy ourselves as to the nature of the contents of the sinus by opening it, proceed to the resection of the jugular, if necessary, and lastly, return to the sinus, clean out the bulb end and obtain hemorrhage by removal of clot in the direction of the torcular.

#### **Epithelioma of the Ear Successfully Treated by the X-Ray.**

DR. F. M. LAW. The patient, a man seventy years of age, came into Dr. McKernon's clinic at the Manhattan Eye, Ear and Throat Hospital August 20, 1909, and was referred to the X-ray Department for treatment. In January he first noticed a pimple on the cheek, just in front of the ear, which grew rapidly in size and was very painful; he could not sleep on that side. In July the ear commenced to discharge. When he entered the hospital the ulcer extended from around the auditory canal out on to the cheek, one and a half inches, and from upper to lower border of auricle; had a bleeding surface and was markedly indurated. The canal was almost occluded, being only about the size of a pin, and a profuse discharge was

coming from it. To the probe the canal seemed to be lined with soft granulations. A section was sent to the laboratory for examination, and a report returned by Dr. Wright with a diagnosis of epithelioma.

The case was treated with the X-ray for ten minutes at a time, three times a week, with a tube of moderate penetration. Treatment was continued until September 25th, when there was a slight reaction, and treatment was discontinued, patient having had sixteen treatments. The ulcer was then smaller, the bleeding had stopped, and there was less induration. Treatment stopped for three weeks. Returned October 16. The ulcer was then the size of a quarter of a dollar, the pain had disappeared, he could sleep on that side, the induration was entirely gone, and the ulcer had a smooth, healthier appearance. The treatment was continued, three times a week. October 23, no discharge was visible; the canal had assumed almost a normal size. On November 5th he was sent to the ear department for examination. The walls of the canal encroached upon each other, and made a view of the drum impossible, but there were no granulations and practically no discharge. November 12, there was a normal sized canal, no discharge, and the ulcer had entirely disappeared. Patient has had 28 treatments. The interesting points in this case are the cessation of the discharge and the enlargement of the auditory canal.

#### Automatic Middle Ear Inflator.

DR. E. P. FOWLER. This little apparatus was presented before the American Medical Association last spring. The idea was to give the patients something which they could use at home to supplement the surgeon's treatment. The ordinary treatment for chronic catarrhal deafness with retraction of the drum membrane loses much of its effectiveness because of its irregularity and infrequency. If the patient is provided with a Politzer bag he is apt to use it too forcibly or too frequently, and he is liable to do more harm than good. This little apparatus gives the patient a definite pressure in the nasopharynx; no matter how much the balloons are inflated, the pressure remains the same, and this is governed by the laws of physics. The apparatus is very simple. There is a nose-piece, which fits into one nostril, and a valve to allow the exhalation to inflate the balloon easily, but which then closes,

so that the air comes back gradually into the nose. After inflating the balloon, the other nostril being closed during this procedure, the patient swallows and repeats this act until the balloon has collapsed. During deglutition the eustachian tubes are opened, and both middle ears are inflated.

The apparatus is made in two sizes, 10 and 20 mm. pressure. You cannot get any more in these sizes. The apparatus is of no use until the treatment has progressed to a point where the pressures obtainable with this instrument are sufficient to force air into the tubes during deglutition.

#### **Improved Ear Trumpet.**

DR. D. B. DELAVAN exhibited a new and improved ear trumpet made by Mayer and Melzer of London. It is similar in appearance to the flexible hearing tube in common use, excepting that the tube is smaller in diameter, and in its interior there is a spiral wire; at the end of this and near the base of the bell-shaped end of the tube is a small vibrating disk, which appears to be attached to the wire spiral. The object of the apparatus was to overcome the unpleasant overtones common in the ordinary instruments used to aid hearing. In conversation with a number of otologists in England, Dr. Delavan was assured that this instrument was a distinct improvement upon the old-fashioned models. It was an entirely new thing to him, and he thought that it might prove interesting to the members. The testimony in its favor was too good to be ignored.

In reply to an enquiry as to whether it could be obtained in this country, Dr. Delavan said that so far as he was able to learn, none of the instrument makers here knew of it. It had recently been presented by Mayer and Melzer. The objectional overtones form a serious blemish to many of the best forms of apparatus for the aid of hearing. This instrument not only makes the sounds more agreeable, but it protects the ear from the effects of unpleasant overtones. It is not an expensive article.



**Paper: Latest Advances in the Study and Treatment of Tinnitus Aurium.\***

By D. BRYSON DELAVAN, M. D.,

NEW YORK.

DISCUSSION.

DR. BRYANT said that he did not know of any disease of the ear which might not be accompanied by tinnitus, and that it could not advantageously be treated as a distinct disease, but rather as a symptom, just as pain is treated as a symptom. Tinnitus is controllable, as is pain, by powerful hypnotics. Treatment of tinnitus consists of treatment of the underlying disease. Whatever treatment improves the condition of the ear will improve the tinnitus. Sometimes the effects of tinnitus become of such importance that it is desirable to get rid of it at any sacrifice. In such cases, where the aural disease will not yield, the most positive help is the surgical removal of the peripheral hearing organ, or better, the severance of its central nervous connection. Except in the cases where destruction of the hearing organ is demanded, there are no methods of treating the tinnitus separately from the underlying disease. When the condition of the ear has been improved the deafness has, in some cases, improved before the tinnitus, and, in some cases, the tinnitus has improved before the deafness.

DR. CHAMBERS told of a case which he has had under treatment for a dozen years. The patient's ear is all right, the hearing is all right, but the tinnitus is such that at times the patient is so distracted and tormented that life is unbearable, and her sleep and health are interfered with. Immediately on going off for a journey the tinnitus disappears, and she will have no trouble until she returns. The patient is a woman seventy years of age, and has everything that money can give. While she is traveling the tinnitus will leave her for months at a time, and she will have no trouble until she returns home. Her suffering is very great. There is a condition of nephritis in the case. She has been put on all the medicines, hydrobromic acid, etc., but the condition is such that what will benefit the nephritis will have no effect upon the tinnitus.

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\*See page 173, March Annals.

In response to a question from Dr. Laws as to whether the nephritis seemed to have any bearing upon the tinnitus, Dr. Chambers replied in the negative. It appeared to be simply an accidental coincidence in the same individual.

DR. FOWLER said that two or three years ago, while experimenting with Bier's hyperemia, he noticed some interesting points in regard to tinnitus. It seemed often to bear no relation to the blood pressure or to the anemia. Sometimes anemic cases seemed to be much benefited. Two or three dozen cases were materially benefited by the constriction band, which they wore every night. One man had not slept for some weeks on account of tinnitus, and the very first night that he wore the neck band he slept comfortably, and did so whenever he wore the band. Whether this was due to the mental effect or to the constrictive effect of the band bringing the blood to the head, he could not say.

In reply to an inquiry as to whether this was a case of pulsating tinnitus, Dr. Fowler said that he did not remember. The man was 50 years of age and was not a neurasthenic. The matter was discussed in the clinic, and the man was told that it was imagination, and was told to leave off the band, but he returned and said that he had to put it on or he could not sleep. He claimed that it stopped the tinnitus and he was therefore able to sleep.

The only way to tell if the constriction neck band would or would not be of benefit, was to try it. In many cases it made the tinnitus worse, while in many it would have no effect on the noises in the ears, but nevertheless would produce restful sleep. Some of Dr. Fowler's patients have been using this band continuously for nearly two years and cannot sleep without it.

DR. HAYS said that among minor operative measures, Dr. Emerson, in the *ANNALS OF OTOLGY*, September, 1907, and Dr. J. W. Jervey, in the *Medical Record*, September 18th, 1909, reported very good results from freeing the adhesions in the fossa of Rosenmuller in cases of tinnitus. He himself had found in a series of cases studied by means of the pharyngoscope, that if the adhesions were broken down and prevented from reforming, by the insertion of a piece of Cargile membrane, very good results were obtained. Replying to a query from the chairman as to how it was done, Dr. Hays said he

inserted the membrane with a probe, passed through the nose, or by placing a piece of the membrane on the finger and passing it through the mouth, and that oftentimes it would stay in place for one to two days. If this were done for a week the adhesions would not form again. In a few cases he had tried strong silver nitrate solutions, but the adhesions had a tendency to reform, as it was a difficult matter to place an applicator deeply into the fossa, even under direct vision.

DR. DUEL said that in reading the report of the meeting at Belfast, which Dr. Delavan had just summarized, he was surprised to see that otologists should still be talking about tinnitus aurium as a disease and not as a symptom—as Dr. Bryant had just said, which is the only rational view to take of tinnitus. It can only be a discussion of a part of the disease, and the only rational view of the treatment is in connection with the treatment of the disease itself. There are two very distinct types of tinnitus aurium; one, a type which is due to conditions in the middle ear, and the other, due to conditions in the labyrinth. We know perfectly well that a number of cases of tinnitus are associated with the middle ear. These are likely to be the low-pitched sounds, and which are pulsating in character. These are the types which can be benefited by treating the middle ear. The high-pitched continuous tinnitus, which accompany diseases of the labyrinth, are the types which are not influenced by local treatment. Personally, he had not succeeded with any constitutional treatment, excepting sometimes with large doses of bromide, when the patient was in a state of nervous depression, until they could get hold of themselves again. Many types of middle-ear tinnitus are permanently cured by removal of the cause—for instance, removal of obstruction in the eustachian tube is frequently followed by a disappearance of the tinnitus. The types which come on with acute middle-ear conditions of the inflammatory type usually disappear with the disappearance of the condition. The labyrinthine type of high-pitched continuous sound is strongly influenced in many instances by electricity, but not permanently. In his earlier experiments with the galvanic current in electrolysis, in the treatment of the eustachian tube, he had a patient who shouted at the top of his voice whenever he came into the office, and it was impossible for him to talk at all unless he spoke at that pitch. He was in the position



of men at Niagara Falls, who shout at each other in order to hear themselves. He had read this article, and having the apparatus he placed the negative electrode on the man's hand and the positive back of his ear, and the tinnitus was immediately diminished so that he could speak in a normal tone of voice, and he could also hear better. As soon, however, as the electrode was removed the man again began to shout. The man was so delighted that he could talk in a normal tone of voice when the current was on, that Dr. Duel rigged up a little apparatus somewhat similar to that worn by the telephone operators, with a small battery, which the man carried in his pocket. By putting his hand in the pocket and making the connection, he could hear when he was spoken to and could talk in a normal tone of voice. In this instance the condition was a labyrinthine tinnitus, which was temporarily influenced by increasing the pitch. Most of these cases are probably due to the hearing of one's own blood current circulating in the blood vessels, like water running through a pipe; you can turn on a certain amount of stream without noticing it, but if you increase that you can hear it. It seems probable that labyrinthine tinnitus is due to some change in the blood vessels. The idea of treating this condition by local massage, which does not alter the blood current, would be absurd. Middle-ear cases, however, can be cured by removing the cause of the obstruction.

DR. MYLES expressed his thanks to Dr. Delavan for bringing up this subject of "the symptom of nearly all diseases of the ear." For many years he himself has been experimenting on many forms of tinnitus aurium, and of course all have many cases which have been cured, some of them rather easily. It seems to him that tinnitus aurium is usually due to some circulatory disturbance, or to some mechanical disturbance of the middle ear or labyrinthine apparatus. The vasomotor nerves in many instances are affected. In 1897 he had published a paper on adhesions of the eustachian tubes to the membranes of the vault of the rhinopharynx.

For many years he has been removing these adhesions and cleaning out the fossæ of Rosenmuller, and in some cases obtained very good results, but not in all. He has also seen cases relieved or improved by the removal of certain deep faucial tonsils; in other cases—such as the so-called gouty con-



dition due to toxemia, causing a deposit from the blood in the labyrinthine structure, as in the joints and in other parts of the body—if the patient is properly treated by the best modern methods, having the colon properly cared for, with proper diet, exercise and other regimen for restoring him to better health, especially when the arteries are becoming more or less hardened, etc., great benefit has been obtained.

In nearly all cases the tinnitus has been stopped for ten to thirty seconds by a very careful pneumatic massage of the tympanic membrane. This favors the theory of circulatory causes.

DR. HURD said that he would like to refer to one point in regard to tinnitus in the early stage of middle-ear catarrh, when it is beginning to go up the tube, with very slight deafness and noise in the ear. In these cases very often the inferior turbinate has quite a little to do with the trouble, and the removal of the lower portion of the turbinate will help the condition. In some cases the velum is pulled back against the postpharyngeal wall and the tensor and levator palati muscles are not functioning normally, and by simply putting in the finger and moderately stretching the velum forward it will help the tube, and going into the fossa of Rosenmuller and stretching that region. It is simply a matter of massage, but some cases have been improved by this treatment.

DR. DELAVAN said that he had taken it for granted that no one supposed tinnitus aurium to be anything other than a symptom. Certainly no one in the discussion of the subject at Belfast thought otherwise. Dr. Barr had called especial attention to the many conditions of which it is a symptom. Of course, it may be associated with almost anything that could happen to the ear, and, of course, some cases differing from it are easily relieved. There are many other cases, however, which are difficult to improve, and some which up to the present time have absolutely baffled every attempt to relieve them. He had met with attempts at suicide in his own experience, and had no doubt that others present had known of similar cases. Certainly a symptom so terrible as to cause a patient to desire self-destruction ought to challenge most seriously the attention of the profession. Great attention had been given to operations of greater or less importance in otology, but the subject of tinnitus seemed to have received less attention than was its

due. The discussion at Belfast was important and it had been ably conducted. It was participated in by some of the best men of the time, and a strong desire had been expressed to rouse more general interest in the subject. It was for this reason that the speaker had asked the privilege of presenting the matter to-night. Not all our cases have been helped, but we may be able to help more of them if more attention is given to the subject than of late years it has received.

**Removal of Petrous Pyramid for Suppurative Disease of the Labyrinth, With Presentation of Two Patients.**

DR. JOHN D. RICHARDS presented two cases in each of which the major portion of the petrous pyramid had been removed. The first was operated on four years ago for simple mastoiditis; four months later, as healing had not occurred, a radical operation was performed. At the time there was no fistula in the outer labyrinth capsule, and the stapes was in position; two weeks later the patient suffered an attack of vertigo. Four weeks subsequent to the radical operation, upon removing fungous granulations from the solid angle of the semicircular canal system, a fistula was noticed at this point, and through this a probe could be passed into the vestibule. Immediate operation upon the labyrinth revealed the vestibule filled with pus, to which pulsation was imparted, the pus issuing in such quantity that it evidently came from the cerebellar fossa; the inner vestibular wall was found necrotic and perforated, and through this perforation an epidural abscess adjacent to the internal auditory meatus was emptying itself. In this case the pyramid was removed up to the internal meatus. A bridge of bone, including the facial ridge and an arch extending over to the internal auditory meatus, included the facial nerve.

The cochlea was filled with pus and was removed, with the exception of its inner wall. In attempting to remove the anterior portion of the inner vestibular wall, which was necrotic, the internal meatus was accidentally opened. The loss of cerebrospinal fluid was considerable and necessitated a discontinuance of the operation. At a later time, after the leakage of cerebrospinal fluid had ceased and the meatus had been sealed off, the apex of the pyramid was exenterated. The extreme pneumatic character of the bone, its large size and roomy proportion and the softening of the apex of the pyramid by disease enabled this to be done with a curette.

The second case was that of a chronic suppuration operated upon by a colleague four months ago. A perisinus epidural abscess was evacuated and the sinus opened for thrombosis; the wound did not heal. A facial paralysis appeared several months after the operation, gradually becoming complete. Upon reoperation it was found that the entire external vestibular wall, together with the arch of the external semicircular canal, was dehiscent, the vestibular cavity filled with pus and granulations, the facial nerve stretched as a bared structure across the cavity and was embedded in the granulation mass. The promontory was intact; upon its removal the cochlea was found occupied with pus, and the entire interior of the cochlea, including the modiolus, was necrotic. The interior wall of the vestibule, while not perforated, was necrotic, and upon removing it, together with the cochlea, the entire length of the internal auditory meatus was exposed. The meatus was represented as a gutter filled with black fungous granulations, and the inflammatory process had so sealed it up that there was no loss of fluid. Upon removing the base of the pyramid from without inward, as the cerebellar dura was separated from the posterior aspect of the petrous shell, an epidural cerebellar abscess was evacuated—its site being internal to the posterior portion of the vestibular cavity, the granulation mass blocking the internal meatus had evidently formed a portion of the abscess bed. The petrous apex was in this instance necrotic and easily exenterated, as there was no facial arch to save and no internal meatus to avoid, by beginning at the posterior aspect of the apex and removing in succession planes of the bone from within outward. This patient had no portion of the pyramid remaining except a part of his carotid canal and that which lies below the level of the tympanic floor. The sagging of the temporosphenoidal dura in this instance obliterated the major portion of the cavity within a week, there being no facial arch to hold the dura in position.

The symptoms in the two cases and their healing presented no features which were unusual.

DR. DUEL said that there were many points in the paper which it would be interesting to discuss, were it not for the lateness of the hour. One point, however, which had struck him with considerable force was the question of the mistake made in the region of the petrous and the cerebellar fossa.



He had an accident of the kind himself, followed by the death of the patient, which he felt was due to injury and subsequent leakage of the fluid into the wound.

DR. JOHNSON said that a most interesting point was that made in relation to the internal meatus as a route to the cerebellar fossa for the draining of the fossa. He had had a case in an old gentleman who fell and struck his head on the railroad track, with fracture of the base of the skull and rupture of the internal meatus, the dura and the tympanum, in which the escape of the cerebrospinal fluid was marvelous in quantity. If the head was turned to one side, after the ear had been thoroughly cleansed, and then in the course of a minute or two it was turned to the other side, a dram or more of cerebrospinal fluid would escape. This condition persisted for a number of days. About the seventh or eighth day the fluid commenced to decrease in quantity. During the period of excessive fluid flow the patient was reasonably comfortable, but as soon as the fluid ceased to flow he became violently delirious, his temperature rose to 104.5. Despite this, however, the flow continued to decrease, and in the course of four or five days the delirium gradually abated, the temperature subsided, and the patient finally made a good recovery, without any cerebral infection whatever. Great care was taken not to infect the injured area. No instruments of any kind were passed into the auditory canal, except the cotton probe and speculum, which were carefully sterilized. The rent in the drum membrane and the line of fracture through the bony auditory canal could be distinctly seen. He had never seen a case in which the cerebrospinal fluid flow from the ear in this case was equaled. It seemed to illustrate the point which Dr. Richards had made in relation to excessive draining of the cerebral fossa through the wound in case of accident during operations for suppurative labyrinthine disease.



NEW YORK ACADEMY OF MEDICINE.

SECTION ON OTOTOLOGY.

*Regular Meeting, December 10, 1909.*

DR. ROBERT LEWIS, CHAIRMAN.

**Paper: Case of Thrombosis of the Jugular Bulb, Etc.\***

BY JOHN R. PAGE, M. D.,

**Paper: The Sero-Diagnosis of Syphilis in Its Relation to Diseases Of the Ear.†**

BY EDMUND PRINCE FOWLER, M. D.,

DISCUSSION.

DR. DENCH said that the report was a most interesting and desirable one, and cited an instance in which the Noguchi test had been of great value. The patient had been an Arctic explorer, who gave an exceedingly indefinite previous history. The patient applied for treatment at the New York Eye and Ear Infirmary, about two and a half years ago. When he first came under observation there was a slight discharge from both ears, and the patient was profoundly deaf. Owing to the profound deafness, it was impossible to obtain a definite history, but, apparently, he had suffered from a purulent discharge from both ears for a considerable period of time. When the patient first came under observation there was a scanty discharge from both ears. The external auditory meatus, upon each side, was extremely narrow. Both canals were filled with a purulent discharge. No perforation of either drum membrane could be made out. The patient complained of considerable pain in both ears, and some slight tenderness about the ears. This could not be definitely located upon palpation, either in the external auditory meatus or in the mastoid process. The patient had been to the hospital, and under regular irriga-

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\*See page 353.

†See page 367.

tion both the aural discharge and all pain and tenderness in the ears disappeared. He remained profoundly deaf and was treated by catheter inflation, at fairly regular intervals, for about one year. The hearing seemed to improve. About a year and a half after the patient came under observation he was placed upon small doses of pilocarpin. Almost immediately he began to complain of severe dizziness and general headache. The pulse became gradually slower and slower. He was admitted to the hospital, and an examination of the blood showed a positive Noguchi reaction. An ophthalmoscopic examination at this time showed hemorrhagic retinitis upon each side, with some slight elevation of each optic papilla. The headache, the slow pulse, and the ocular changes, were sufficient almost to warrant a decompression operation. Bearing in mind the previous aural history, the caloric test was applied to both ears, and both labyrinths were found to react normally to this test. Owing to the positive Noguchi reaction, the patient was placed upon hypodermatic injections of salicylate of mercury, and was also given iodide of potassium in exceedingly large doses. Under this internal medication all of the cerebral symptoms immediately disappeared and no operative interference was necessary.

Dr. Dench reported the case simply because it showed the value of the application of the Noguchi test in all doubtful cases of intracranial symptoms following a history of possible aural suppuration. The possibility of previous middle ear suppuration could not be excluded—neither from the appearance of the drum membranes when the patient first came under observation, nor from the appearance of the drum membranes at a later period, when the patient first complained of his cerebral symptoms. At this later period both drum membranes appeared thickened and indicated a possible previous suppurative process. Had the Noguchi test not been applied an operation might easily have been performed for the relief of the cerebral symptoms. The successful outcome of the case shows the advisability of applying this test in every doubtful case.

DR. FRIDENBERG inquired whether the apparent preponderance of female children had been analyzed, on the statistics of the incidence of males and females in the general population or in the clinical population, and also whether the positive reaction was an indication of the specific character of the ear

disease, or indicated merely that the patient was syphilitic. The tuberculin test, as all know, is open to the same source of error which has seriously interfered with its usefulness. In the presence of a positive v. Pirquet or Calmette reaction we cannot be sure that the florid iritis or other affection for which we are treating the patient, is tuberculous, as the positive reaction may be due to some old tuberculous gland in the mediastinum or similar old, concealed condition, and the eye or ear affection may be entirely nontubercular. The comparatively high percentage of positive reactions in nerve deafness was certainly most striking and confirmatory of what we assume as to the etiology of this affection, and the low percentage in suppurative processes also corresponds to clinical experience. The paper has brought out some valuable points, and the speaker had no doubt that the doubtful ones, too, would be cleared up by Dr. Fowler.

DR. BACON congratulated Dr. Fowler upon his valuable contribution to this important subject. He had been particularly interested in what had been said about chronic catarrhal cases, and has wondered whether they might not be syphilitic, and this point ought to be studied more thoroughly.

DR. SHEPPARD inquired whether or not these so-called catarrhal cases were of the otosclerotic type. We have been wondering in regard to the etiology of otosclerosis, and syphilis has been suggested as a probable etiologic factor, and it occurred to him that it might be positive in the otosclerotic rather than in the other so-called forms of catarrh.

DR. HARRIS inquired in regard to the treatment—whether when Dr. Fowler found positive reactions he at once proceeded to put the patient upon antisppecific treatment, and if so, whether he noted improvement immediately. He had reference particularly to adult cases, where previously satisfactory results had not been obtained. That would clear up the question which Dr. Fridenberg has asked—whether it was general syphilis or syphilis of the ear.

DR. FOWLER, in closing the discussion, said that in regard to the proportion of each sex reacting positively he had probably not been heard, but that he had stated it was in children, two males to five females; the total number of cases in children was, males 25, females 41. In figuring the percentages, allowance had been made for this difference in the sexes. Likewise

in adults, due allowance was made for the number of each sex examined.

In regard to syphilis in ear disease being the cause or having relationship to the disease of the ear, he had tried to be careful, by stating that the positive reactions or the syphilis was present with the ear disease. He did not know, but inferred from the large percentage of syphilitics in these cases (so much larger than Dr. Noguchi had found, in his series of cases in which syphilis could be excluded), that the syphilis must have had a baneful influence on the otitis. In 335 cases Noguchi found only twelve which gave a positive reaction; seven were lepers and five were as detailed. The scarlatina case was very interesting from the fact that all of the serodiagnosis tests had failed to give negative reactions in many cases of scarlatina. When this case reacted positively, every one said—there you go, the same as Wasserman; but this child had an abscess on the leg, and when operated upon by two well-known surgeons infected them both with syphilis from this abscess. That was very strong evidence, with a vengeance, that the test was reliable. In other words, Noguchi's tests did not follow the other tests in giving unreliable reactions in scarlatina.

From the large number of positive cases in persons who had no other disease but ear disease, it might be inferred that there was some connection between the syphilis and the ear disease, and Dr. Fowler believed that there was some connection between the syphilis and the ear disease, particularly as these reactions occurred in the class of cases in which syphilis might be expected to be more prevalent. It is true, most of these gave specific histories, but they all reacted positively, and in this class of cases those that gave no specific history also reacted positively. We cannot state that all the cases giving positive reactions surely have syphilis, but this is a fair inference in the large majority of instances.

The question of otosclerosis was kept in mind and was mentioned in the summary, but he had not definitely diagnosed any case as otosclerosis, as he found great difficulty in making such diagnoses. With very few exceptions they were tested by Dr. Fowler's improvement of the Gellé test, and they all apparently showed a movable stapes, and he, therefore, doubted if there were any true cases of otosclerosis in the series, but he thought otosclerosis in many instances would give a positive reaction to the test.



He stated in his paper that all the adults improved under antisyphilitic treatment. Of course, they had also their regular treatment, and they might have improved anyway. One woman before the treatment could not distinguish anything except light and darkness, and she could not hear without her ear trumpet. After about eight months of treatment, she can hear without her trumpet and she can read. There was no doubt about that case, of course. The children were all given the antisyphilitic treatment, but they also had regulation treatment for their ear disease. He thought that the iodides and mercury, when indicated, did, without doubt, help the patients.

**Paper: Thrombosis of the Lateral Sinus. When Should We Operate and What Type of Operation Should Be Performed?\***

By E. A. CROCKETT, M. D.,

BOSTON.

DISCUSSION.

DR. GRUENING said that he felt he voiced the sentiment of the Section in thanking Dr. Crockett for his very able paper and for bringing this subject up for attention. He did not believe, however, that the paper would be attacked as Dr. Crockett seemed to think, for the practice in New York was practically the same as that in Boston. There may be a difference in some minor points. In the diagnosis of the disease some things are important—the rise and fall of temperature. There is no other ear disease which has such oscillations in temperature, with apparent perfect well-being of the patient. The diagnosis of sinus thrombosis is not always easy. In a case of ear disease where such temperature is exhibited we have to consider also other conditions. He had seen a case recently with high temperature in ear disease. There were chills and a lowering, a sudden fall of the temperature. He had not known the patient long, and he consulted with the family physician, and he said, "Don't operate, the patient has malaria, and if you give him quinin he will improve." This was done, and in a few days the man with ear disease lost his chills. In another instance that came under his observation recently, the general physician was called in, the Widal test was made, and it was found that the patient had typhoid fever. These things must

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\*See page 356.

be noted, if possible. It is the common practice in New York to view the sinus before ligating the jugular. When the diagnosis of sigmoid sinus thrombosis has been made the jugular is ligated, but it is not common practice to ligate without inspection of the sigmoid sinus. It is true that every sigmoid sinus does not indicate disease, but most sinuses do, and therefore, acting upon the fact that most sinuses will show disease, it is better to expose the sinus before we conclude to ligate the vein. What to do with the jugular vein when it has been ligated is another question. He himself has been in the habit of ligating very low and excising the whole jugular as far as possible; and as there always remains a stump of the jugular that is infected and drains into the wound, it is not wise to close the wound in the neck. Strapping the wound after a few days causes the wound to heal almost as rapidly as if it had not been left open, and the cicatrix which results does not constitute a deformity. Upon the whole, he felt that most of the members would agree with Dr. Crockett that we should operate as early as possible and as radically as possible. It would be correct and logical to consider sinus thrombosis alone without combining it with meningitis and abscesses of the brain and other conditions. Sinus thrombosis is a disease *sui generis*, and should be considered as such. If we have a case of sinus thrombosis and the patient dies of meningitis, it is not the thrombosis which caused the fatal issue. We should leave out all these cases of meningitis, for we cannot cure meningitis, and we cloud the statistics by adding meningitis. We can cure abscess of the brain very often. Only recently he had seen such a combination, where an abscess of the brain on the left side was diagnosticated, on the ground of optic aphasia. The patient also had sinus thrombosis, and he recovered. It is an easy matter to remove the jugular completely. It does not require any great anatomic knowledge to do this. The radical operation should be done. The only point on which he would differ with Dr. Crockett was regarding the treatment of the jugular vein. In a few cases he has found the whole jugular thrombosed, from the bulb to the clavicle. He removed the whole jugular, and the cases recovered. We should not despair in such a case even. We should remove as much as we can, and very often the patient will get well. The sinus thrombosis has nothing to do with meningitis or abscess.

and if we consider the question of sinus thrombosis alone, the mortality from sinus thrombosis will be greatly reduced. We should probably have 90 per cent of cases in pure sinus thrombosis, and perhaps even more than that.

DR. BACON said that he was very glad to hear the statistics that Dr. Crockett had reported, for they certainly make a splendid record, and we cannot show anything better in New York. Dr. Gruening has spoken of other causes of variations in temperature, which might be mistaken for cases of sinus thrombosis, and he would like to call attention to a condition in the case of a female infant, which he saw two years ago. The child had an acute otitis media, and had a rapid rise and fall of temperature, and it was a question whether or not it was a case of sinus thrombosis. The urine was examined, and a number of specialists saw the case. Operation was deferred for some time, as they could not decide that it was a case of sinus thrombosis. It was well that they did, for in spite of the fact that many examinations were made of the urine, it was not until later that it was discovered to be a case of pyelitis. The patient recovered. These cases should be looked for, especially in female children.

He was glad to hear what Dr. Crockett has said about the importance of not wounding the sinus during operation on the mastoid, for he himself has had several cases where he has opened the sinus during operation, and it is important to be very careful in operative work upon the mastoid not to injure the sinus. He fully agreed with Dr. Crockett in regard to the shock which the patient suffers from when the int. jugular vein is excised, and the operation certainly has been done in a number of cases where it was not necessary. It adds much to the gravity of the operation.

In acute cases where the thrombus has not broken down, he has been in the habit of simply removing the clot from the sinus, and then waiting for twenty-four hours. In most of these cases excision of the vein is not necessary, and it is better to wait, in many cases, especially in children, for it adds much to the gravity of the case to do the complete operation by excising the vein at the same time.

DR. MCKERRON said that, excepting in one or two minor points, the method spoken of by Dr. Crockett did not differ from the one he had described in a paper read in Boston some



five years ago. At that time he was asked if he had left the ranks of the conservatives and joined the radicals. He had advised that when the diagnosis of sinus involvement was made the sinus should be exposed and opened; then, if any evidence of pus or broken-down clot was found, to stop the operation, go down, expose, ligate, and resect the jugular vein. If, on the other hand, there was no evidence of pus or disintegrated clot, remove the septic material in the sinus and do not ligate the vein. As to ligating the vein and leaving it in, it has not been his practice to do so, even at the present time, where involvement of the sinus and vein has been made. In some instances he has done a primary ligation where the case had been under observation only a short time and came in with all the symptoms of vein involvement, and also distinct tenderness in the neck, resecting it and going in and evacuating the sinus of the contents above.

Dr. Crockett had spoken of ligating the vein and leaving it. Does he ligate it above or below the facial? If below the facial, it would seem that the pathway for a free infection was still left. He agreed with Dr. Crockett that in some cases it is wise to do a removal of the vein at the time of exposing the jugular and ligating it. That depends entirely on the condition of the patient at the time of operation. If the patient is in a fair condition, and you ligate below the point of thrombosis, the vein should be resected, for if you leave the septic vein in situ it will give trouble sooner or later.

In ligating you cannot remove all the vein above. There is a little stump which empties septic material into the wound above. In all the cases in which he has done a ligation he has left an open space for drainage and inspection for five or six days following. That, however, is optional, and depends upon the method of the individual operator.

He would like to learn from Dr. Crockett if all the veins removed in these sixty cases were examined microscopically, or only a certain number of them. The number of successful cases reported was certainly very gratifying; probably the cause of the favorable results in the hospital with which he is connected are due to early operation. At the present time in New York he doubts whether they would be operated upon so early as in Boston. Dr. Crockett's paper emphasizes what he had said five years ago about the importance of early operation when once the diagnosis is made.



DR. WHITING said that he agreed with Dr. Gruening that the members of the Section were not likely to take any violent issue with Dr. Crockett. Most of them agree that early operation is important—the earlier the operation the better the patient's chances for recovery. Some of the symptoms which he regards as necessary evidence of sinus thrombosis, however, seem very radical. If these same rules were applied to children, some veins would be tied off where there was no excuse for it. He recalled a case, and was sure others could do the same, of a remarkable exacerbation of condition in a child, which, so far as the temperature was concerned, would lead one to infer that some large blood channel was infected. Some years ago he had showed a temperature chart in which the child had a variation of nine degrees in temperature, and excepting for that appeared to be perfectly well. The physician in charge wanted him to go into the mastoid and sinus, which, however, he would not do. After a certain length of time the temperature dropped and the child got perfectly well. If he had been as radical as Dr. Crockett seems to be, he would have gone for the jugular first, and then and there tried to satisfy himself as to which side should be opened in looking for the sinus.

He had hoped that in speaking of convincing symptoms of sinus thrombosis the question of bacteremia would be brought up, for the more he sees of bacteremic work in reference to mastoiditis the more convinced he becomes that there is a definite and positive value in the observations. Many cases of simple mastoiditis which he has operated in the past year have been detected by blood cultures. The cases have been examined, and in no other cases of simple uncomplicated mastoiditis have bacteria been found present. A similar result has been announced this month in the *Med. Woch.* by Leggett, in which he mentions twenty cases of sinus thrombosis, in all of which streptococcus were found. In a vast number in which blood cultures were made, all of which were negative, and in which they found staphylococcus, it was simply the result of contamination from the skin from not having the surface properly cleaned.

In going into the sinus, the majority of the symptoms which Dr. Crockett had mentioned were well recognized, and in those cases where we have those symptoms no one would hesitate

to go in and operate for sinus thrombosis; but some lack just the degree of necessary convincing symptoms, and may not have the extreme exacerbations we look for; they may have ill-defined chilly sensations, the nurse may have overlooked the fact that there have been chilly sensations, and while one may strongly incline to the belief of that condition the symptoms may not be sufficiently definite. It is in just this class of cases where he feels that a blood culture made by a properly qualified bacteriologist would be of great assistance in deciding whether or not to operate, even though other symptoms which are usually considered essential may be missing.

In regard to the jugular, after it has been determined that there is a sinus thrombosis, he usually gets very good results. He believes in putting the ligature as low down as you can get it, and then extirpating the vein as far as you can go. In one or two cases where he left the sheath of the vein in, it became infected, and had to be opened. He therefore removes as much of the vein as possible, without unduly prolonging the operation. He believes in removing the vein as far as possible toward the clavicle and upward to the point of its emergence from the base of the skull.

As to the wisdom of doing a uniform removal of the jugular before opening the sinus, he is not yet convinced that this is a wise procedure. Last spring he had a case, in which he was assisted by Dr. McKernon, where there was a clot in the bulb—not in the dome, but in the beginning of the bulb—a parietal clot, in which there was no difficulty in expelling the clot—it came out like the pit from a ripe cherry—so both agreed that it would be a conservative procedure not to ligate the jugular. The sinus was accordingly packed off, and there was an uneventful recovery. He has had many other similar cases. His present attitude is much the same as it was a year ago, when he read a paper on the subject before the Section. He had said then that it was in the interest of conservative surgery to give the patient a chance to get well without opening the jugular. He does not feel so convinced of that now as then, but he cannot say, given a definite recognizable clot in the sinus, that you should ligate the jugular before opening the sinus and making an attempt at its removal.

DR. SHEPPARD said that Dr. Crockett had referred to the frequency of the occurrence of sinus thrombosis in acute as

compared with chronic middle-ear suppurations in a manner which concurs with his own experience. In regard to the advisability of early operation, the earlier the better after a distinct diagnosis is made.

As to the jugular, he put himself on record ten or more years ago as being in favor of tying off and resecting the jugular in all instances. Since then, after listening to other men's experiences and looking over the results of cases, he feels that he must confess to a modification of his former view, and at present, excepting only in extreme cases, it is his habit to investigate the sinus first. As a general rule, he opens the sinus and notes whether there is a return flow from above and below, and feels that by so doing he gives the patient a chance to get well without destroying the jugular. Although he feels more comfortable and more happy when the jugular has been tied than when it has not, still the statistics show that an equal number have gotten well, whether the jugular was tied or untied. As regards the question of resection, as contrasted with simple tying off of the jugular, it has been his custom to resect from as low down to as high up as possible.

As regards cases with high temperatures, two weeks ago last Monday two cases came under his observation—one a child of seven or eight years, in which the family physician called him up and wanted him to see the case. After hearing about the temperature and a brief history of the case, Dr. Sheppard made a diagnosis over the 'phone of lateral sinus phlebitis. The child was sent into the hospital, and was operated upon within an hour or two, and a very evident unhealthy sinus was found, in which the clot popped out from below, as Dr. Whiting had described. The doctor contented himself with this and a radical mastoid operation, and the child is progressing rapidly toward health.

On the same day a six or seven month old infant was sent into the hospital as a case of sinus phlebitis, the diagnosis having been made by the attending physician. The history was that the temperature had been running from normal to  $105^{\circ}$ , with a regular daily curve, reaching normal at certain times in the morning and  $105^{\circ}$  or thereabouts later in the day. He examined the child's ear, and saw simply a slightly congested pair of ear drums, not bulged, and he felt very doubtful about there being any effusion into either of the tympanic



cavities. In order to satisfy himself and clear himself of any possible criticism, he incised the drums freely, and put the child on the usual after-treatment. The incision had no effect on the temperature, which continued exactly as it had been for several days, an absolutely regular curve. The blood was examined, and no plasmodium was found; the Widal test was negative. The ear healed up in three or four days, but there being some remaining congestion one of them was again cut. The child is still running a temperature.

All that quinin would do was to delay the top of the curve by about four hours. He was under considerable criticism for not going in and opening the sinus, but could not bring himself to believe that it was a case of sinus disease. The child does not appear to be septic, and has no chills or blueness of the extremities preceding the rise. The only symptom is the temperature. He said that he would appreciate any suggestions that might help him out in the case. The case is still under observation, but he feels unwarranted in going in, for there is no indication as to which bulb should be attacked, and he could not feel that the sinus was involved. In reply to a query as to whether a blood culture had been made, he replied in the negative.

DR. ALDERTON said that Dr. Crockett's paper had given considerable food for thought, and he would certainly read it over carefully when it was published. A point that seemed to him to be of value in these cases is not only the leucocyte count, but having a differential count made every day—to watch the polymorphonuclear percentage. In his experience that was of more value than the leucocyte count alone.

He would like to emphasize one point made by Dr. Sheppard—that is: the danger of disseminating infection by the force used in chiselling. It has been his custom, recently, in cases of sinus thrombosis, or cases giving evidence of some meningeal irritation, not to use the hammer and chisel, but to uncover the mastoid thoroughly below the tip, cutting away the sternocleidomastoid muscle, then biting off the tip with rongeurs, and working up with the rongeur and curette. This is quite easily done in the majority of cases.

DR. DENCH agreed with Dr. Alderton regarding the importance of taking a series of blood counts, in these cases, if any definite information was to be obtained. If a blood count is to



be valuable a series of observations must be recorded. Occasionally he had seen a high polymorphonuclear count in cases of sinus thrombosis. In other instances, however, when sinus thrombosis, with extension into the internal jugular vein, had been demonstrable at the time of operation, there had been no increase in the number of polymorphonuclear leucocytes. The differential blood count was, therefore, confirmatory, if positive, and of absolutely no value, if negative. A great deal had been said by different speakers regarding the value of the white blood count. An increase in the number of white blood cells simply indicates that the patient is developing a good resistance to the septic infection. It is of no value at all in establishing a diagnosis of sinus thrombosis. The accidental opening of the lateral sinus had not, in the speaker's experience, proved a serious matter. This accident had happened to him a number of times, and in no instance had it been followed by sinus thrombosis. In his earlier practice he had been very much disturbed by the accidental opening of the lateral sinus, but at the present time—provided the operation had been conducted under proper aseptic precautions, he did not feel that the accidental opening of the lateral sinus was a matter of any great gravity. Naturally, he avoided the accidental opening of the lateral sinus whenever possible, but, in his own experience, it did not interfere with the favorable progress of the case in a single instance. It had been the speaker's rule to clear out the mastoid thoroughly and to remove all purulent foci from the bone before invading the region of the lateral sinus. If this plan of procedure is followed, and the sinus is accidentally opened late in the operation, there is very little danger of infection.

Regarding the occurrence of metastases after the removal of a septic clot from the sinus by means of the curette, this had never occurred in the author's experience. He had many times curetted the lateral sinus for the removal of septic clots, and always with exceedingly favorable results. The statistics published in the author's last edition of "Diseases of the Ear" demonstrated conclusively that, in early cases, a septic thrombus could be removed from the sinus with perfect safety without previous ligation of the internal jugular vein. In cases of early thrombosis, his procedure is the same as that of the other gentlemen who have already spoken—that is, Dr. Dench

always opens the sinus and cures out any clot present, care being taken that before the curette is introduced downward toward the jugular bulb pressure be applied to the internal jugular vein, in order to prevent the possible aspiration of air into the right side of the heart. In cases where the sinus thrombosis is well advanced, as, for instance, where there is actual free pus in the sinus, and where the return circulation from below is not readily established, it is then his practice to ligate and remove the internal jugular vein at the primary operation. In these advanced cases he deems it better surgery to place a ligature about the internal jugular vein, low down in the neck, prior to the removal of the clot from the lower end of the sinus.

While Dr. Crockett's statistics as to the comparative value of simply ligating the vein, in preference to excising it, seemed very convincing, the speaker felt that he would not be justified in adopting this procedure. He believed it to be important that the internal jugular vein should be completely excised, in every instance, where a clot was demonstrable in the jugular, or where the sinus thrombosis was well advanced. In other words, if the jugular was interfered with at all, it should be excised from a point in the neck well below the limit of the clot to a point as near the base of the skull as possible. All tributary branches should be carefully tied off and divided between two ligatures. Dr. Crockett's statement that, in certain cases, it was advisable to tie the vein through its clotted portion, seemed to the author absolutely unwarrantable. In every case where the vein had been tied so as to allow a certain portion of the clot to remain below the point of ligation, these cases had terminated fatally. He cited the statistics of Grunert in justification of these ligations and remarked that Grunert had cited, at least, two cases where a ligature was placed about the innominate vein in instances where the jugular was found to be occupied by a clot throughout its entire extent. In the cases where the speaker had met with a thrombus occupying the jugular throughout its entire length, the condition of the patients had not warranted the application of a ligature to the innominate, as such an extensive surgical procedure would undoubtedly have proved immediately fatal. He believed, however, this to be the procedure of election in these cases. The objection to the simple ligation of the internal

jugular, without excision of the vein, and without ligating the vein above the facial, depended upon the fact that, owing to the free collateral circulation which exists between the internal jugular vein of both sides, through the facial veins, a thrombus in one jugular vein would probably infect the general circulation through these collateral vessels. It seemed to the speaker imperative that the entire infected vein should be removed, and that the facial vein of the affected side should be tied off, if such general involvement was to be avoided. Regarding the treatment of the wound, in cases where the jugular was excised, the author stated that it was his practice to close the superficial wound completely, excepting at the lower angle and at the upper angle. A rubber-tissue drain was usually placed in the lower angle of the wound, this drain extending beneath the deep fascia, in order to completely drain the dead places. At the opening left at the upper angle of the wound an iodoform gauze packing was inserted, so as to prevent infection of the deeper structures from the upper end of the vein. In fully 75 per cent of his cases primary union of the neck wound was obtained.

DR. DÜEL said that we all gain from personal experience ideas that are bound to influence us. His own views from such experience led him at present to feel that in a case of undoubted sinus thrombosis the important indication was to cut off the infected area from the general circulation with the least possible shock to the patient. That this might be accomplished by the ligation of the jugular vein and the blocking off of the lateral sinus above the clot, Dr. Crockett's statistics had clearly shown. These cases demonstrated that the cause of death is the passage of infection into the general circulation, and that when converted to a local condition the infection could be easily coped with. Statistics have shown the world over that cases operated upon during the first week after the infection have been cured in twice as many instances as when operated during the second week. These statistics include operative procedures which simply open the sinus and evacuate the clot, as well as those in which the vein is also ligated. The method of operation is not of as much importance as the early diagnosis and cutting off of the infected area from the general circulation. However, in a case in which the sinus gave no physical evidence whatever of a clot, when from the symptoms he was,



nevertheless, led to operate, he would be inclined to tie off the vein before interfering with the sinus; experience has shown that such cases may have a clot in the jugular bulb which may or may not be evacuated, and yet the patient recovers if the blood current has been stopped in both directions. He believed that altogether too many cases had been lost in an effort on the part of the operator to "demonstrate a clot," or establish a flow of blood from both ends.

If Dr. Sheppard desired any support in not operating on the infant with a widely oscillating temperature, but no other signs, he would find scores of charts in the Babies' Hospital in which wide vacillations of that type occur in infants under two years of age—many with and many without middle-ear suppurations. Last year he had presented two exactly similar charts with varying temperatures, from  $99^{\circ}$  to  $105^{\circ}$ , for many days, one with a double suppuration of the ears, and the other without any evidence of ear trouble. In neither case was there any definite evidence of a septic blood clot to account for the condition. He could show scores of charts in which a diagnosis of sinus thrombosis, from vacillating temperatures, had been seriously considered, owing to the concomitant otitis. Most of these cases recovered. In some of the earlier ones his personal feeling had been that an operation was advisable. In one of them, in particular, in which death occurred, he had opportunity to examine the case, and found the sinus perfectly clear. He had, therefore, modified his judgment regarding the significance of wide vacillations in temperature in infants.

DR. KENEFICK said that there were one or two points on which he would like to say a word. He was glad that the treatment of the sinus here in New York after it had been exposed had been made clear to-night by those of large experience in these cases, and the question definitely answered—whether or not we should curette the jugular bulb before the internal jugular vein has been tied off. In Dr. Dench's clinic years ago there were many recoveries, and that was the result looked for in cases in which the clot was successfully removed from the jugular bulb. From the experience of those who had spoken to-night, we can now formulate a fairly definite mode of procedure according to the condition of the sinus wall and the nature of the clot.

He had been much interested in what had been said about



children, for it corresponded with his own experience. If he had any criticism of Dr. Crockett's paper to offer, it might be that he had not laid sufficient emphasis upon the difficulty of diagnosing this condition in young children and infants. It would seem that a different mode of procedure should be followed from that pursued with adults, at least in children under three years of age. Last fall, at the same meeting before which Dr. Duel presented his temperature charts, he himself had told of two cases at the Foundling Hospital with suppurating ears, each under three years of age, and each with typical sinus thrombosis temperatures at the same time. His attention was directed to the first child too late, for it was in such a condition that he did not feel that operation would avail, although it seemed quite clear that the child was dying from venous poisoning. There was no sign of mastoiditis in either case. In the second case he was anxious to operate, but the mother refused to let him do so. A postmortem examination of the first case showed a primary thrombosis of the jugular bulb; the second case, which, to all intents and purposes, presented exactly the same picture, recovered without any operation whatever and without having a definite diagnosis made.

In the case referred to by Dr. Sheppard, if he were called upon for suggestions, he would advise a blood culture at the earliest possible moment; if it were positive, it would prove the nature of the case, but if negative it would not prove anything.

DR. FRIDENBERG said that the value of the blood culture was so great that he would beg to bring up the subject of this diagnostic aid again and add to what Dr. Whiting had said. The importance of blood cultures was certainly not sufficiently recognized, as indicated by the fact that it is not a routine measure, as it should be, with the exception of possibly a single New York institution, while the discussion to-night indicated very clearly that otologists were still attaching a great deal of importance to the differential leucocyte count. If, as has been said, an early operation is important in sinus thrombosis, then any method which will enable us to make an early diagnosis of, or to exclude, thrombosis must be of the greatest value. Dr. Crockett considers the high, remittent temperature, with chills, characteristic, as do all of us, and advises operation after a three days' continuance of such a typical condition. But what if we can save two days? What, if after the

first unexplained rise of temperature or the first chill, we make a blood culture and have positive findings? We can make the same test, instead of waiting, where the temperature curve is atypical, or in the cases mentioned by Dr. Duel and others, where in children it was misleading. All these cases would have light thrown on them by study of the blood cultures. Again, after removing a clot from the sinus, as in the cases mentioned by Dr. Whiting, are we to wait for renewed rise of temperature and chill before ligating or exsecting the jugular, when blood culture will give us definite information? Positive cultures persisting will indicate a continued entrance of bacteria into the blood current from a source of sepsis in the sinus, while negative cultures will as definitely prove that this source of infection has been eliminated. Anyone who has had the least experience with bacteriology, or even the assistance of bacteriologists in a case or two, ought to know that a single negative finding means nothing. In their recent authoritative publication, Libman and Celler review four or five reasons which would occur to us on consideration. Thus, the removal of an insufficient amount of blood, few bacteria in the blood, their development after the culture was taken or their disappearance before, and so on. Bearing these purely technical exceptions in mind, they lay the utmost stress on the diagnostic and prognostic importance, not only of positive, but almost equally of negative, and this means repeatedly negative, blood cultures. The fact that a sinus thrombosis has been seen in a certain case and that a single blood culture showed nothing; this fact, I say, also shows nothing. As indicated by the reader of the paper, the clinical signs may be misleading; pyelitis, central pneumonia, typhoid, malaria, may be mistaken for sinus thrombosis, and there is not always the definite history of a recent mastoiditis or even of previous ear disease or ear operation. At Mt. Sinai Hospital a number of cases had been diagnosed with the aid of the blood culture, which had come into the general ward. In spite of the inconclusive nature of the clinical symptoms, which we are told here invariably decide the diagnosis, these cases were recognized as cases of sinus thrombosis and transferred for operation to the otologic division, where the diagnosis was confirmed on the operating table.

DR. GRUENING recalled the fact that he had read a paper on

the subject, showing the importance of the positive results in blood culture. The negative result does not show anything. There may be a clot. Quite recently he saw a case of sinus thrombosis, but the blood culture was negative. The symptoms of sinus thrombosis were so distinct that he decided to operate, in spite of the negative results of the blood culture, and a sinus was found filled with pus from the lower knee to almost the torcular. The positive blood culture is of value; the negative blood culture shows nothing; there we must rely upon the clinical data, which are of more importance than the blood culture.

DR. CROCKETT said that to his mind the weak point in his paper lay in the differential diagnosis between sinus thrombosis and malaria, for those are the easiest to confuse.

There was one disease which he had not mentioned in the paper which has been the cause of much distress to him—the coming on of pneumonia in children who present a high polynuclear percentage, and have the symptom of septicemia. He could see no way of doing this unless the bacteremia would help. Pyelitis also gives a high polymorphonuclear count and a high leucocytosis, and is a very difficult condition to diagnose.

In reply to the query as to whether these examinations were all from the ligated jugular vein, they were taken from only 35, and he only quoted that number. It is now a routine method.

In regard to ligating only, he felt that the objections which had been brought up were purely theoretic. He has never seen any trouble result from leaving the vein in the neck once it is ligated. He has done forty other cases besides those here reported, making 100 in all—in all of which he tied below the facial, and he has never yet seen a thrombosis, except from one to the other, giving a general metastasis. Since he has followed this method he has never seen any metastasis at all. He was led to be emphatic on this point by two very distressing cases—one of these was a fine woman whom he knew, who had a thrombosis of the lateral sinus. Before tying the jugular he opened the lateral sinus and cleared it out. The next day there was a double thrombosis of both axillary veins, and the patient died of moist gangrene. That process came from curetting the sinus and not tying the jugu-

lar first. In the next case the patient was a child, and while on the operating table exploring the lateral sinus the patient died.

The autopsy showed embolus from the lateral vein, and instant suffocation of the child. These instances convinced him of the necessity of tying the jugular first. It is very easy to do it, and then tie above all you want. If Dr. Gruning's suggestion of excluding the cerebral cases—with which he agreed—his records would show prolonged life in 52 cases, with a very low mortality. If they are included, we have a recovery of 90 per cent. He believed that the mortality was very much lower than is obtained by interference without ligating the jugular vein. The time of recovery in these cases was about four weeks.



NEW YORK ACADEMY OF MEDICINE.

SECTION ON OTOTOLOGY.

*Regular Meeting, January 14th, 1910.*

**Paper: The Report of a Case of Cerebral Abscess Occurring in Connection With a Chronic Middle Ear Suppuration.\***

BY HUGH B. BLACKWELL, M. D.,

NEW YORK.

DISCUSSION.

DR. KENEFICK said that he had been much interested, because there is great difficulty in diagnosing the true conditions present in such a case. In the first place, the case gives a history of a year's discharge. It is a question whether one would be justified in doing the radical operation on a case with a discharge for a year previously unless there was evidence that it was absolutely necessary. It would seem that the headache in this case would be the keynote upon which to proceed. Headache is almost pathognomonic of brain involvement—either an epidural or a subdural abscess. Dr. Blackwell had raised the question of stirring up a latent abscess. The speaker said that he himself had succeeded in stirring up such an abscess by a very slight operation in the canal, and bringing the patient's life to a sudden close.

Another point was the question of multiple abscesses which might be raised in this case. Dr. Whiting claims for his encephaloscope that it gives such a view that one is not likely to overlook any secondary abscess in the neighborhood. It is barely possible that additional abscess cavities might have been present. We are always led to believe that we must associate a low pulse with cerebral involvement, but Krause, in a recent work, maintains that there can be a great deal of intracranial pressure without specially lowering the pulse.

Dr. Blackwell said that when the dura was exposed in the tympanic cavity granulations were present, which appeared

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\*See page 376.

healthy. That is another point—that the dura can appear perfectly healthy and have healthy tissue between the cavity and the source of the abscess. One might raise the question as to the best method of opening into the abscess. That point has been thoroughly threshed out in this Section, and the weight of opinion has been in favor of opening into the brain as near the point of origin as possible. Dr. Blackwell had done well to get through and through drainage at the lowest point. The cavity should be thoroughly emptied by this method.

DR. BRYANT said that there was little left for discussion after Dr. Blackwell's treatment of the subject, although the time of the origin of the abscess might be considered. That question could not be finally decided, however, as there had been no autopsy. When Dr. Blackwell first saw the dura it was normal; the second time, it was abnormal. That fact spoke for a recent occurrence of the abscess, and the condition of its walls were in favor of an acute process. On the other hand, the early headaches would indicate a latent process. The argument is, perhaps, as good on one side of the question as on the other. There was no definite proof.

The question of the treatment was purely surgical. And such cases should be treated along the general surgical lines which produce the best drainage possible. This can be done only through a wide brain incision. The trouble in most cases of brain abscess is that the surgeon is afraid of cutting into the brain, and most of the incisions are not large enough. The site of the infection should be thoroughly exposed, and the incision should be triangular, with a wide base. Brain hernia is not dependent as much upon the incision as upon the increased interchondral pressure resulting from the infection.

DR. BLACKWELL, replying to an inquiry in regard to eye symptoms, said that the eyes had been examined, and there was no evidence of papillitis.

**Paper: Latent Mastoiditis With Epidural Abscess.\***

BY ALFRED BRAUN, M. D.

DISCUSSION.

DR. KENEFICK said that he was sure the members were grateful to Dr. Braun for bringing this subject to their atten-

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\*See page 381.

tion, for it was most important that these cases should be recognized as they pass through the clinic. It is marvellous how much destruction of the mastoid bone, granulation tissue, and formation of pus can go on with apparent freedom from pain and without giving the least temperature. He had thought much about the reasons for the absence of pain and temperature in such cases, and Dr. Braun had given a very good explanation. His own experience has been that such patients had rather a thick than a thin cortex, and that they have had a large mastoid process with innumerable cells, through which the pus could slowly disseminate, and allow the brain to adjust itself to the conditions. The edema of the posterior superior wall is a regular symptom, well recognized in all cases of mastoiditis. He has frequently operated on that symptom alone, when the patient could blow through the drum and the discharge had apparently ceased. Another characteristic sign was noted in the character of the perforation, which often becomes titlike and protrudes from the drum.

Dr. Braun had not gone into the subject of the bacteriology. Dr. Dixon, at the New York Eye and Ear Infirmary, has reported in a number of these cases that the microorganism most frequently found responsible is the streptococcus capsulatus. This organism produces exactly this condition in all cases. These are the cases that are sometimes brought into the hospitals in a comatose condition. They go home perfectly well, apparently, but we should be on the lookout for them, especially when they have made one recovery and return complaining again. They frequently say they have no great pain, but they cannot sleep.

Dr. BRYANT said that Dr. Braun's grouping of those cases is a very useful and important one. Such cases are not usually overlooked in the aural clinics, but they are frequently overlooked in the general clinics. His remarks as to the importance of recognizing cases of this kind is quite correct. When the symptoms occur while the patient is convalescing from acute middle ear conditions, they are always a dangerous sign. Dr. Braun's leads up to another, where there has been no perforation from the middle ear abscess. Dr. Bryant has seen cases like this, where the middle ear appeared normal, but where there was a history of recent middle ear inflammation.

DR. RAE said that these cases of latent mastoiditis were of great interest and occurred in the experience of all. Each of such cases has had a more or less acute stage, and the moral of the story is, that the acute stage is the time to operate, before toleration is established.

For various reasons, operations will not always be permitted, so that doubtless these cases will continue to be seen from time to time. Their occurrence would almost justify the view that once the diagnosis of mastoiditis has been established immediate operation offers the best safeguard to the future welfare of the patient.

**Paper: Observations on Pathologic Conditions of the Nose and Throat, With Special Reference to the Tubal Regions Associated With Chronic Middle Ear Catarrh. (A Study of Fifty Cases).\***

BY HAROLD HAYS, M. D.,

NEW YORK.

DISCUSSION.

DR. KENEFICK: The pathologic conditions described tonight in cases viewed during life have been minutely described in German literature before 1850, and the bearing they have in producing ear disease was dwelt upon at that time, though, of course, the examinations made were postmortem. This is astonishing, especially when we consider that examinations of the tympanic membrane in the living were made by the greatest otologists by daylight reflected from a hand mirror. It seems now that we can examine the nasopharynx in the living being by Dr. Hays' apparatus. It is impossible to discuss this subject fully, as it is too extensive; the whole evening could be devoted to the conditions in the nasopharynx alone.

Dr. Kenefick said that he was especially interested in what had been said about the relations between deflected septa and the ear. Many years ago he himself had been interested in trying to make out whether the ear on the side of the stenosis was constantly affected, and he finally concluded the air conditions in the nasopharynx were so disturbed that the deflection could affect either one or both ears. He wouldn't touch

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\*See page 295.



upon the pathologic conditions of the nose, for they are well known, but the pathologic conditions in the nasopharynx have been described to-night in such a way that it is a pity the inclement weather had prevented a larger audience from being present to hear and discuss the paper. We have heard to-night a description of the basic cause of perhaps 95 per cent of all ear diseases; that is saying a good deal, but after many years of observation of these conditions, especially in children, he has come to the conclusion that the conditions which have been described in the fossa, overhanging the tube, protruding against it, and interfering with its drainage and ventilation, are at the bottom of those diseases of obscure origin observed in the internal and middle ear. They are probably due to the vascular conditions produced by these growths and obstructions in the fossa of Rosenmüller and about the mouth of the tube. Finally, it is perfectly evident that when the eustachian tube is closed or its action is interfered with, a middle ear disease of some kind is sure to follow.

With regard to the conditions which keep up vascular engorgement, the general poisons, tobacco and alcohol, must be kept in mind. The subject is so extensive that it is impossible to decide which ramification is most interesting to consider, but he wished to insist upon the fact that unless the adenoid tissue is removed from the fossæ of Rosenmüller, any and every operation is a failure, so far as the ear is concerned. This is a most important point in these days, when physicians are selected for their duties in the public schools and in some other quarters. We all know that the removal of adenoids is considered by some a very slight operation and treated lightly, but it is the duty of the physician to fully understand this procedure and see that a child who is subjected to this operation should have the complete benefits which always follow its proper performance.

Dr. Cocks said that Dr. Hays' remarks in regard to the fossa of Rosenmüller interested him especially. For some time he himself had been paying particular attention to this subject whenever he examined a nasopharynx. In addition to adenoid tissue in Rosenmüller's fossa, he has frequently seen mucofibrous bands running across the fossa. In one such case, observed at the Manhattan Eye, Ear and Throat Hospital, there was a large fibrous band, nearly as thick as a lead pencil,

which crossed from the tubal orifice to the wall of the nasopharynx.

Dr. Cocks stated that he has not found the uniform improvement in hearing claimed by many writers who have reported catarrhal deafness cured by operation upon Rosenmüller's fossae, although he has faithfully followed up the after-treatment to prevent recurrence of adhesions. He believes, however, that this method should be tried whenever indicated.

Dr. BRYANT said that Dr. Hays' excellent pharyngoscope would lead to a more intelligent study of the condition in the nasopharynx. He would like to say a word on the subject of pharyngotympanic ventilation. Dr. Hays used a catheter to discover whether the tube were open or not. Now, it may be physiologically closed, and yet be opened; with a catheter properly introduced any tube not cicatrized can be opened. One must employ a very delicate test for the physiologic function of a tube. Dr. Bryant has always used either Valsalva's, or Politzer's inflation, and in order to observe the drum membrane during the inflation, has placed the tube in his own, as well as in the patient's ear. In most cases the motions of the drum membrane can be seen during the inflation, although in a few the drum membrane is so rigid as not to yield at all to the pressure.

He has tried Dr. Hays' instrument for some time. It is easily used, and one obtains a view of the nasopharynx that can be had in no other way. The value, however, of the examination would be increased if it were supplemented by the older salpingoscope, with which one can see the motions of the tubal cartilages. Dr. Hays' instrument does not permit a very good view of the cartilages when the patient is swallowing, whereas if you look through the salpingoscope the cartilages can be observed during the act of swallowing.

Dr. KENEFICK: With regard to breaking down the adhesions in the fossa of Rosenmüller he could say nothing, as he had not tried it in a sufficient number of cases to speak authoritatively, but in four or five cases which he had operated upon under nitrous oxide gas, he had not met the success which he had expected. The adhesions which were broken very soon became attached again, and the benefit which was apparent at first did not last. In regard to the thimble of which

Dr. Cocks had spoken, he did not himself believe in using anything but the finger, and he doubted very much whether it was possible to get any mechanical appliance which would properly clean out the fossa of Rosenmüller without doing damage. The finger is the proper thing to use.

DR. HAYS, in conclusion, said: It was not my intention in this paper to do more than impress upon you the great variety of pathologic conditions of the nose and throat, especially the nasopharynx, which directly or indirectly cause chronic middle ear catarrh. It has been my experience that the treatment of the ears is of secondary importance; if the pathologic condition of the nose or throat is treated properly, the improvement in hearing will often be quite marked. Such an example is shown by the following case, which came to me four months ago. The patient, a man, nearly seventy years of age, was almost totally deaf, not being able to hear a watch at the left ear, and about one inch from the right ear. He was very much discouraged, as he was given practically no hope by many of the most noted specialists. I told him I would give him a month's trial. During that time I treated the nasopharynx directly, making applications of medicaments through the nose into the nasopharynx, which I had in view by placing the pharyngoscope in the mouth. At the end of four weeks a watch could be heard six inches from the right ear and over one inch from the left ear. Very little attention was paid directly to the tympanic cavities.

In regard to adhesions in the fossa of Rosenmüller, I do not wish to leave the impression that simply the removal of them, without any other treatment to the tubes or nasopharynx, will cause a cure of a middle ear catarrh. Of course, it is impossible to say whether they are responsible for the catarrh; I can only state that in the cases that I have examined I have never found a chronic middle ear catarrh without finding some adhesions in the fossa of Rosenmüller. The holding of the carygile membrane in place is often a matter of chance. In some cases it will remain in the fossa one or two days. Where it does so, there is certainly no question that it aids considerably in avoiding the reformation of new adhesions.

NEW YORK ACADEMY OF MEDICINE.

SECTION ON OTOTOLOGY.

*Regular Meeting, February 10, 1910.*

**Mastoid Curettes.**

DR. HUGH B. BLACKWELL presented some mastoid curettes.

**New Rongeur Forceps.**

DR. BRYANT showed two forceps—one a heavy rongeur with a long lever, which he has been using for four years in removing the mastoid tip, cortex and calvarium. This rongeur is especially advantageous, because it saves a great deal of time.

Dr. Bryant also exhibited a smaller rongeur, which he has recently designed, and which has proved effective in removing the smaller, deeper parts of the bone. This instrument is especially adapted to removing the bridge of the annulus tympanicus in the radical operation.

**Paper: The Classification of Middle Ear Diseases on a Pathologic Basis.\***

BY S. J. KOPETSKY, M. D.

DISCUSSION.

DR. PHILLIPS said that he had given careful consideration to the arrangement which Dr. Kopetsky had made with the object in view of improving the classification of middle ear diseases. One point, which is particularly worthy of emphasis, is that it clears up in a way that all can understand and presents a definite classification of those diseases which we call catarrh, for the reason that we have no better term, and those which we call suppurative. The so-called catarrhal affections are nonbacterial, not due to bacterial invasion, and are the acute conditions which give rise to an inflamed drum, with or without an infusion into the tympanic cavity, but are

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\*See page 319.



never purulent in character. One distinctive feature in this class of cases is that the drum is always retracted, in contradistinction to the purulent invasions where the drum is bulging. This point, at least, is worthy of comment. Dr. Phillips said that he was impressed with its importance from having gone over the literature of the text books, and in almost every one, in the final discussion of the cases which we are prone to call catarrhal invasion, the textbook will say that the disease may eventuate in suppuration, whereas, in fact, it never does, except when a new invasion is superimposed upon the original condition.

As to the question of the seriousness of the marginal perforation, he was not sure that it always represented a serious type of disease. When located in the attic region or the posterior superior of the drumhead, there was greater probability of extensive necrosis than otherwise obtained; but it was not common to find these perforations perfectly dry and healed, wherein no serious complications had ever occurred.

DR. GRUENING said that he had not had time to examine the classifications very carefully, but when a new nomenclature is presented, based upon pathology, the name of "otosclerosis" ought to be considered. It is described in this paper as spongification of the labyrinthine capsule and as an osteitis rarificans. If this is so, why should the name otosclerosis be retained?

DR. FOWLER regretted that he had been unable to go over the proposed classification very carefully, but he would like to ask one question. The writer of the paper had brought out very strongly that catarrh of the middle ear was not of bacterial origin. Why may not a catarrhal process in the middle ear be due to bacterial origin, especially if secondary to acute rhinitis.

We have much to learn about all catarrhal processes, and it may be that many such are due to ultramicroscopic bacteria, or to various conditions modifying the virulence or the activities of known bacteria.

Along the same lines of criticism that Dr. Gruening had expressed, he would take exception to the phrase "pathologically understood."

DR. KOPETZKY, replying to Dr. Gruening's remarks, agreed with Dr. Gruening that the term "otosclerosis" was incorrect

as a scientific term, applied to a lesion signifying a spongification of the labyrinthine capsule. He said that he was always happy to follow Dr. Gruening's teachings, and that he would gladly accept any suggestion for a different term to be thus used. At the same time he begged to remark that he had not attempted to invent any new terms, but had tried to classify the diseases and conditions under the names which were commonly understood. Regarding typographic errors in the printed schedule, he felt that he must apologize for the poor proof reading on the part of the lay printer.

In closing, Dr. Kopetzky remarked that a classification such as had been presented could not be discussed within so short a time, and that he wished it to be understood as a sort of preliminary report on the subject, and that he hoped that a further study of its details would commend it to the members.

**Paper and Lantern Demonstration: "Symptomatology and Pathology of Diseases of the Labyrinth."**

By HEINRICH NEUMANN, M. D.,

VIENNA.

NEW YORK ACADEMY OF MEDICINE.

SECTION ON OTOTOLOGY.

*Regular Meeting, March 11, 1910.*

**Paper: Report of Two Cases of Lateral Sinus Thrombosis Treated, Postoperatively, With Hiss' Extract of Leucocytes.\***

By SAMUEL McCULLAGH, M. D.,

**Paper: The Practical Value of Serum Therapy and Use of the Leucocyte Extract of Hiss in Infections of the Ear, Nose, and Throat, With Reports of Cases.†**

By J. G. DWYER, M. D.,

DISCUSSION.

DR. SONDERN expressed his thanks to Dr. Dwyer for the very able and comprehensive paper presented. He had had the advantage of being allowed to look it over closely before coming to the meeting. It presented better than most others he had read the present-day position of vaccine therapy. Dr. Dwyer's experience, on the whole, corresponds exactly with that of other good men who have used this procedure carefully and conscientiously. It seems well that renewed interest has been awakened lately in vaccine therapy, for there is without doubt much value in it. The important point for the clinician is to learn in which conditions its use is valuable. In the preliminary program of the Congress of Physicians and Surgeons, to be held in Washington soon, the entire general session on Tuesday, May 3, is given up to this subject, and there will be papers presented by Hektoen, Gay and others, which will be discussed by Adami, Stengel and others. The Executive Committee has also recommended to each component association that the subject of vaccine therapy be assigned to the afternoon session, to be treated from its especial standpoint by speakers from its own members.

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\*See page 387.

†See page 394.

There were two points in Dr. Dwyer's paper which the speaker desired to emphasize, namely, his remarks on the limitations of the treatment, and particularly those on the contraindications. He believes there is no one who has not seen one or more cases in which the administration of vaccines has not resulted in definite, undoubted harm, due to this administration and not to anything else. Those that he has seen were all tuberculosis cases. The caution which Dr. Dwyer has sounded against the improper use, especially, of tuberculosis vaccine cannot be too strongly emphasized. He recalled four cases, one of which resulted fatally, and the other three were undoubtedly harmed by this treatment.

It is now six or seven years since Wright made his original claim that by means of bacterial vaccines we have the power of raising the antibacterial power of the blood and thus overcoming every disease due to bacterial agency. The procedure was made attractively complete by the description of the opsonic index determination, by means of which we could definitely determine the degree of opsonic fault, the degree of result obtained on treatment, and learn the time when the injection of vaccine should be repeated. Experience has taught two things: the limitations of vaccine therapy and what seem to be good reasons for this, and that the opsonic index determination is inconstant and impracticable.

One of the first things taught by Wright was that when you have a local acute or subacute or chronic lesion without acute systemic infection, you will invariably find that the opsonic value of the patient's blood serum for this organism is reduced as compared with the opsonic value of a normal person for the same organism; and that the use of the vaccine would temporarily still further reduce this opsonic value, producing the "negative phase," which would be followed, however, by an increased opsonic value, or the "positive phase," both phases lasting for longer or shorter periods, the degree varying not only in different patients, but in the same patient, according to the dose. These are the cases in which vaccine therapy is useful.

On the other hand, in cases of acute systemic infection, a high opsonic index is the rule; in other words, the patient's serum contains more opsonin than the normal individual. The reason that no benefit is obtained from the vaccine under these



circumstances is not that there is not ample opsonin in the blood serum, but that the body cells are exhausted and can form no more antibody. It is antibody they want, not opsonins, and antibody cannot be introduced by injections of bacterial vaccine. That is the reason why vaccines are not only useless, but are even contraindicated in cases of acute systemic infection where there is a bacteremia. Another statement Wright made in the beginning, which is interesting and which applies here, is that the opsonic value of the blood serum will increase only in case the patient's resistance is proper; provided the patient has the power to react; and that ought to be constantly in mind when considering the use of vaccines. The opsonic power will increase only if the patient has the power to react, in other words, has the ability to form antibody.

Concerning the value of the opsonic index determination, the speaker begged to differ with Dr. Dwyer. He has labored with it for a considerable period of time, and in his hands it has certainly proved impracticable and inconstant. At one time he was very much interested in what had the indications of becoming an exceedingly useful diagnostic procedure and followed the work, not of the hospital interne or novice in laboratory technic, but that of skilled and well drilled men who were doing nothing but laboratory work of high order. He has seen such men at work, side by side, observing each others' technic and watching for faults, and still the results could not be compared, though the material was obtained at the same time by all and worked over by all with as nearly uniform technic as possible. Not only that, but the trial was made to distribute the same material to workers in Baltimore, Philadelphia and Boston, and the results varied widely on each trial. This work was not done carelessly or by novices, but tests were made by well trained, skilled men, several of them pupils of Wright, who were seriously giving their best attention to the trials, anxious to have them succeed, as the procedure would be of the greatest usefulness in guiding the users of vaccine therapy, and to it could be ascribed a good portion of the success attained. Even in the days when the opsonic index was looked to for the indication in the use of vaccine, the proper clinical indication was always accepted if the two did not agree. This is the stand we must take to-day. Most of the recent writings on this point cover it very well, but because there is

some question, at least concerning the value of the opsonic index, this does not necessarily limit the usefulness of the vaccines, though their successful use demands the closest expert clinical observations.

Another very important and valuable point was made by Dr. Dwyer, concerning the cases in which there is a mixed infection with tuberculosis. Thomas of Philadelphia in a recent paper in the *Journal of the American Medical Association*, makes mention of this fact. He says that in his experience there is frequently, together with the tubercle bacillus, a streptococcus or a staphylococcus infection, and in some instances at least, the fever seems to be due to this complication. If the streptococcus or staphylococcus infection is removed first, and the tuberculosis vaccine then used the outcome is often very satisfactory.

Dr. Dwyer had mentioned a number of cases of pyocyaneus infection, and Thomas described others in his article, no result being obtained from the use of vaccines. This would seem explained by both Dwyer and Thomas in their articles. An article was recently published concerning pseudodiphtheria vaccine used in cases of middle ear disease without result. In these cases an antitoxin would probably be more useful than a vaccine. Many interesting points have been discussed concerning the pneumococcus. Dr. Dwyer had mentioned one case with a chronic pneumococcus infection which did well after vaccine treatment. A virulent pneumococcus, a truly virulent pneumococcus, it is claimed, is not acted upon by opsonin and is not taken up by the phagocyte. A nonvirulent pneumococcus is frequently found in pyogenic processes and is taken up by the phagocyte, and its vaccine would certainly increase the phagocytic action. There is another interesting article which has appeared, in which it is claimed that the use of tetanus antitoxin, diphtheria antitoxin, antistreptococcus serum, etc., increases the opsonic value of the patient's blood. These sera do not contain opsonin, but they contain substances which may be converted into opsonin or which stimulate the formation of opsonin. In determining the dose to be used and the interval between doses, painstaking clinical observation is essential. It is also well to remember Wright's original statement that the best value is obtained by having the positive phase as continuous as possible, with as little negative phase interruption as

circumstances will permit. Every dose produces a negative phase or diminution in opsonic value, its degree and duration depends somewhat on the dose. Then it rises and remains above normal for a longer or a shorter period. Large doses seem to make a long negative phase, and while the positive phase is high it seems to be of short duration. Dr. Dwyer's caution not to use doses too large thus seems justified. Keep to the dosage that Wright and others have used and advised. Some days ago I learned of a vaccine being used which contained streptococci, staphylococci, pyocyaneus, and pneumococci in one dose. A combination of this kind is not to be recommended. If different vaccines are to be used in one case they should, I believe, be tried one after another, instead of combining them in this way.

A word in regard to the value of the autogenous vaccine. There is no doubt that the autogenous vaccines will show better results than those made from stock cultures. Published experience would seem to indicate that one is not justified in using a stock vaccine except in cases of tuberculous or gonorrheal processes, where the difficulties of making the autogenous vaccine and the time it takes to produce it are the only arguments against autogenous and in favor of stock vaccines.

DR. SAMUEL LLOYD said that he had come this evening hoping to get some information on the subject under discussion, and he had been abundantly paid. The paper read to-night is one of the best that he has heard in a very long time. The subject had been covered so thoroughly that little remained for discussion. He had spent a good deal of time during the day in looking up his own clinical histories at the hospital and in preparing some criticisms of the treatment with serum, from his experience with different preparations, but the writer of the paper had met them all, and consequently the notes he had brought in his pocket would have to stay there.

The question had been covered in such a well balanced way that he could only approach it by speaking of his own experience with vaccines and with Hiss' serum, rather than on the general phases. In his hospital services they had started using the stock vaccines, and they had exactly the experiences brought out in the paper, and by Dr. Sondern—a remarkable lack of uniformity and in results, and frequently a lack of any result at all—and they almost reached the point of discontinu-



ing treatment. They also had the experience of using it in cases of general sepsis, bacteremia, only to find that they were getting into deeper water all the time, some of the patients dying sooner, he believed, than if they had been let alone.

Then they changed their plans and adopted the autogenous sera, and for the first time began to get satisfactory results. During the last few months in his last service at St. Francis' Hospital, in his private work, and in some of the work during his present term of service at the Post-Graduate, he has had some remarkably good results by using the autogenous serum, and he is convinced that that is the thing.

He has had better results with the gonococcus serum in the stock than with any of the other sera; it would seem that the gonococcus serum was the most efficacious, but they got no results in specific vaginitis cases in children until they began to develop an autogenous serum, when some improvement was noted. This phase of hospital work interests all, for it is very difficult to keep the children free from that infection; and if the slight experience that he has had with this in the last few months is borne out by future work along the same lines, it will be the first indication that he has had in his whole professional career of anything that would thoroughly control the infection. All that he had to say was only in the way of congratulation and corroboration of what had already been said.

DR. HASKIN said that both Dr. Dwyer and Dr. Sondern had stated that the bacillus pyocyaneus had been unsuccessfully treated by vaccines. In the *Journal of the American Medical Association* of February 26th, 1910, Lieut. A. C. Christie, U. S. A., in the Philippines, reports eight or nine cases of middle ear disease, chronic cases, which had been treated in every other way; finally he made vaccines and treated them, using pyocyaneus vaccine in four cases. Invariably, at first, there was a very strong reaction and great increase of the symptoms and secretion, but this was followed by practically drying up and cure.

These same cases of pyocyaneus infection have been greatly benefited, in Dr. McKernon's clinic at the Manhattan Eye and Ear Hospital. In a number of cases where they had been treated for months with bichlorid, boric acid, resorcin, and every other known chemical, without any result whatever,



they started three or four months ago by washing out the ear with plain water, thoroughly cleaning the ear, and then filling it with massolin and allowing it to remain for fifteen minutes before wiping it out. The results have been remarkable. In half a dozen cases where the radical mastoid operation had been performed, and where there was still secretion, under this treatment the discharge had ceased. In one case a patient with a large polyp, suffering with diabetes mellitus, had been treated by having the polyp cut off and massolin applied, and in four days the ear was free from discharge and has remained free ever since. It does not cure caries or necrosis; but for clearing up offensive secretions and restoring the ear to a clean aseptic condition it has worked better than anything he has used for fifteen years.

DR. DWYER, in closing the discussion, and referring to what Dr. Sondern had said about the opsonic index, said that in any case where it is a question whether to go by the clinical symptoms or by the index, one should be governed by the clinical symptoms. The index does give something to go by in the majority of cases; you cannot compare what occurs in the test tube and what occurs in the body, but it certainly is an aid in those clinical cases we are called upon to treat. Wright has receded from his original position on that subject—that is, the all-importance of the opsonic index. Regarding mixed vaccines, in addition to giving them separately, he said that it is better to grow them separately— isolate them on plates—for one variety will grow much more rapidly than another; and if grown together, we may think we have the proper dose of each, when it may be composed of practically one vaccine, the other growing much more slowly.

What Dr. Lloyd had said about the stock vaccines proving more satisfactory with the gonococcus than the autogenous vaccines was very interesting. That has also been his own experience. In two cases he used the stock vaccine entirely; in another case he started with the autogenous vaccine, and obtained no result; he then changed to the stock vaccine and obtained a cure. He could not say why. This is contrary to what is generally found when using autogenous and stock vaccines.

## NEW YORK OTOLOGICAL SOCIETY.

*Meeting of November 22, 1909.*

DR. JOHN L. ADAMS IN THE CHAIR.

### **Congenital Syphilis With Congenital Nystagmus.**

DR. W. C. PHILLIPS reported the following case: H. D. F., aged 16 years, white, a student.

*Family History.*—Mother, Russian, aged 42 years, uneducated. Says she has always been in good health. Gives history of nine pregnancies, with six miscarriages, five occurring prior to birth of patient. During sixth pregnancy mother was given pills for eight or nine months by her physician. The next (seventh) pregnancy terminated in a miscarriage. The eighth and ninth pregnancies, children born at term, apparently healthy and well developed.

Father, Hollander, aged 43 years, educated, intelligent. Says health has always been good until four or five months after marriage, when an eruption appeared which was pronounced syphilitic. It was then learned that his wife had contracted syphilis some four or five months prior to their marriage.

*Past History.*—Patient born at full term, was small, weighing four pounds. Had blisters on soles of both feet. Since childhood her health has been fairly good. She had measles and pneumonia when seven, pertussis at ten, and was operated for enlarged tonsils when eleven. Has had spontaneous nystagmus, disturbance of equilibrium since birth and has been extremely nervous since childhood. Has always had nasal obstruction, difficult breathing and nasal speech. Development has been normal and she seems well nourished and in good health. Has attended school and made fair progress. She gives no history of previous ear disease or disturbances of the aural functions. Wasserman test, made some time after treatment commenced, was negative.

*Blood Examination*, November 27th, by Dr. Coffin.—Erythrocytes 4,270,000; hemoglobin 70-80; leucocytes 7,000. Dif-

ferential count: Polynuclear 74; large lymphocytes 4; small lymphocytes 18; eosinophiles 0; other forms 14. December 9, 1909, the Wasserman and Noguchi complement-fixation test was made and found to be negative.

Examination of urine, normal.

On the morning of November 4, 1909, when she awakened, she complained of pain in the right knee and ankle, and she could not use her right arm and leg as well as on the opposite side. She complained also of vertigo, tinnitus, deafness and also of hearing her own voice when speaking. The deafness increased rapidly and became marked, especially in left ear. Had no headache, pain or fever. Appetite good, bowels regular, sleeps well, but more nervous than usual. When walking she staggered to the right side.

*Examination.*—Right knee and ankle swollen and painful to the touch, but no redness. Temperature and respiration normal, pulse accelerated. Slight muscular weakness of right arm and leg. Sensations normal, reflexes all exaggerated. Examination made some days later, patient standing with feet together and eyes closed, swayed to left, but feels as though falling to right side.

*Examination of Nose and Throat.*—Marked deflection and spur of septum. Turbinates hypertrophied. Adenoids and post-pharyngeal catarrh. Uvula and portion of soft palate gone, and latter adherent to postpharyngeal wall on left side.

*Ear.*—Right membrana tympani retracted, normal color. Left membrana tympani congested and infiltrated. Both eustachian tubes patulous and easily inflated.

*Functional Tests.*—Weber fork heard right side. Rinne negative in both ears. C<sup>2</sup> fork heard in left ear by air and bone conduction. C fork by bone only. Moderate voice heard in right ear 3 feet; whisper not heard. Very loud voice heard in left when close to ear. When Barry's Voice Apparatus is used in right (good ear), neither loud voices, tuning forks nor voice can be heard in left, showing total deafness in left ear.

*Caloric Test.*—Hot and cold irrigation of left ear gave no reaction. Hot irrigation of right ear increased nystagmus to right, and cold to the left side. The quick component, however, always to right side. Nystagmus increased when eyes turned to extreme right, or left, or upward and downward, stopping some after fixing eyes on object in central field of vision.

*Subsequent History.*—Patient developed an arthritis in both knees and ankles, which increased in severity, and she was admitted to the Post-Graduate Hospital on November 26th, where she was kept under close observation. The arthritis was severe, affecting both knees and ankles, which were greatly swollen, painful and tender to the touch, but little redness. Temperature  $101^{\circ}$  to  $104^{\circ}$ , pulse 120, respiration 28. This continued for seven or eight days, when temperature became normal and remained so. There was stiffness and partial ankylosis of both knee joints, which soon passed off as the disease abated, and massage and passive movements were used. During this period she developed a rash from the iodid of potash.

*Medicinal Treatment.*—Mercurial inunctions (1dr.) once daily. Saturated solution of potassium iodid m. x. t. i. d., rapidly increased. The mother, misunderstanding the directions, gave the inunctions three times a day, and patient became thoroughly mercurialized in about four days, when mercury was stopped. She was then admitted to hospital. Pilocarpin hydrochlorate was now given twice daily and increased until its full physiologic effects were produced (gr.  $1/15$  to  $1/8$ ), and this was continued for 10 days. The arthritis still keeping up, pilocarpin was stopped and salicylate of mercury  $1/10$  gr. given hypodermically every other day, and the potassium iodid again given and rapidly increased to m. 75 t. i. d. She was given massage daily and hot applications were made to her swollen joints. The legs were drawn up, and her knees could not be extended without causing severe pain. There was rapid improvement of the joint affection, and she was able to leave the hospital on January 7th. She has since been under the care of Dr. Schoomacker. Her hearing in the right ear had much improved, but the deafness in left ear remained unimproved. Soon after returning home she developed a keratitis in right eye, for which affection a solution of atropin sulphate (grs. ii to oz. i), two drops, instilled in eye. It was given three times a day until pupil became thoroughly dilated, then continued once a day. The iodid was rapidly increased. Patient was now given succinimate of mercury (gr.  $1/8$ ) two to three times a week, and the iodids increased to 120 m. three times a day. After a few days of this treatment she improved rapidly. Her appetite



became good, she slept well, gained in weight, and her disturbed equilibrium improved. Her right ear also is much better, but the left is not improved. The iodid of potash was now increased to 140 m. three times daily. She continued improving in every way except the hearing in left ear, which is totally destroyed.

Neurological report made by Dr. Zabriskie showed the chief complaint was stiffness of legs, apparently due to local joint changes. Also great vertigo on extreme position of eyes and staggering. Vesical and rectal functions were normal, and her stomach condition seemed to be a purely localized affair. On examination we found that she appeared to be normally developed and well nourished. Attitude was one of uncertainty, head and occiput inclined to right shoulder. Facial innervation equal on both sides. Marked lateral and vertical nystagmus. Also decided interference with the conjugate ocular movements and a tendency to inward rotation of the right eye. Tongue protruded in the median line, normal. The gait was uncertain and slightly staggering, but not distinctly titubating in character. Rotation of the head in any of the planes produced no marked effect on the station. No ataxia of the arms or gait. Romberg absent, but a rather broad base was necessary for the maintenance of the erect posture. That is, she was unable to stand quietly with the feet close together. The tension reflexes were all exaggerated, but no clonus or Babinski phenomenon were present. Sensory disturbances, either deep muscular or cutaneous, could not be demonstrated. Mentality fair, average intelligence.

My conception of the case is one of congenital syphilis, while there are most probably irregularly disturbed foci throughout the brain, with developed mental deficiencies, at all events, in that region of the tegmentum, which serves as the connecting pathway from the third nerve nucleus to the cerebellum. There are also undoubtedly atropic changes in the cerebellum itself.

Examination of eyes by Dr. Woodward shows latent congenital nystagmus. When not congenital, such nystagmus may be due to lesions of internal ear. Right eye, bluish exudate on margin of optic disk and associated membrane and blurring of retina. Retinitis. Optic disk in moderate stage of yellowish white atrophy. Left eye, some endarteritis and blurring

of the retina. Retinitis believed to be specific in character and congenital type.

#### DISCUSSION.

DR. GRUENING said that these cases of congenital nystagmus were not at all rare, for he had seen many cases. Congenital nystagmus was usually associated with albinism. The fact that there was nystagmus present did not entitle one to make the diagnosis of syphilis.

The question of operation in these cases was a very interesting one. Should they operate or not? There was a diagnosis of suppurative labyrinthitis made; but in many cases of this nature there was no suppuration whatsoever. In many cases there were symptoms of labyrinthitis, but the condition of the patient could not be improved at all by operation. In these cases there was no doubt but that the labyrinth was involved, but that did not necessarily mean that there was any labyrinthine suppuration present.

DR. DUEL said that most of the men who recently had written upon this question of nystagmus in connection with aural disease believed that the oscillatory movements seen in this type of nystagmus were not in any way connected with vestibular irritation. Nystagmus of vestibular origin was characterized by slow oscillations in one direction, followed by a rapid return to the normal position. In the case presented there appeared the type which was seen in all albinos.

DR. ALDERTON believed that in such cases there was a chronic inflammation of the endosteum, with development of new osseous tissue, and, therefore, operation would be of no benefit.

DR. BERENS asked Dr. Phillips what treatment the patient had received.

DR. PHILLIPS replied that the patient had been in the institution only six or eight days and was under mercurial treatment by inunctions. He asked if many of those present had any such cases, and that they give him suggestions as to the giving of mercury and iodid of potassium in such cases.

DR. GRUENING said that he had seen a number of cases of this kind, and treatment of any kind did not avail. The deafness would persist, in spite of any treatment employed.

DR. MCKERNON reported the case of a child, eleven years of age, in whom hypodermics of bichlorid of mercury were employed. There was absolutely an absence of anything in

the way of air conduction. The deafness began when the child was seven years of age. Besides the bichlorid of mercury injections, pilocarpin was given. During the past year the patient had become practically deaf. Treatment had been continued for about eight weeks, and she had improved to such an extent that she now could hear loud conversation at a distance of eight feet.

DR. HARRIS said that there was one particularly discouraging feature in the care of these patients, which is that we occasionally get a temporary improvement. He recalled one case seen by Dr. McKernon with him; in this case a very excellent improvement in hearing was obtained by the use of hypodermic injections of pilocarpin, given with the mixed treatment of mercury and iodid of potassium. This improvement in hearing was maintained for weeks. The patient could hear ordinary conversation very well. In this case, however, treatment proved to be of no permanent avail. It was a recent case, and the mixed treatment was used.

DR. MCKERNON said that the case he referred to, when away from observation, drank heavily and stopped the medication. The result was that the deafness returned on these occasions.

DR. BERENS reported a case seen by him four or five years ago. The patient was a girl, about eighteen years old, who improved rapidly under large doses of iodids. He started in with the mixed treatment, the protoiodid of mercury and iodid of potassium. He finally stopped the mercury and gave enormous doses of iodid of potassium. One ounce every day was given; this was continued for two or three months. This patient improved very much; in fact, the improvement was very marked. This patient for a time was lost sight of, but returned because of again becoming deaf. Bone conduction was entirely lost. Under treatment this patient again improved, but not as rapidly as when under the first treatment. This patient was under observation for about two years.

DR. LUTZ asked if Dr. Berens remembered the case of a man with labyrinthine syphilis, in whom improvement followed the administration of large doses of iodids.

DR. BERENS replied that the secret of success in these cases was the giving of large doses, and the only way to get the stomach to tolerate these large doses was by giving the iodids



diluted and on an empty stomach; he advised giving the iodids well diluted one hour before meals, making sure that the stomach was empty. This had been his custom since he was an interne in the Philadelphia Hospital, where they received and treated many cases of syphilis. It was the custom of Dr. Charles K. Mills and Dr. H. C. Wood to give these enormous doses; as much as one hundred and sixty (160) drops of the saturated solution of iodid of potassium were given three times a day without upsetting the stomach at all.

DR. GRUENING said that the question depended upon whether the deafness was absolute or not; if there was any hearing left, they should treat the case; but if the deafness was absolute no improvement would follow treatment of any kind; if there was the least remnant of hearing the case should be treated vigorously. He usually gave the iodids in large doses before meals in syrup of ginger.

DR. BERENS believed that the action of the skin should be considered when giving these large doses of the iodids, using hot baths, blankets and other resources for producing sweating.

DR. McKERNON said that the pilocarpin treatment should be employed as long as one could do so without depressing the patient. He said he had used this treatment twelve weeks at a time. This patient was not under his direct observation, but under that of another man.

DR. DUEL believed that in such cases they should not despair of getting relief; such cases of syphilis, when seen early and directly after the acute attack, should be treated vigorously. He recalled a case of this nature. The patient had a sudden attack, during which he became unconscious for a time. It was a very well marked case of syphilis. After the patient recovered consciousness, there was complete deafness of one side. The patient was unable to hear any tuning fork or even the Galton whistle in that ear. Dr. Duel then gave him enormous doses of potassium iodid. He made a quick recovery from his unconsciousness, but for some time had vertigo and a staggering gait. At that time he had nystagmus. No very careful notes of the case were taken, for at that time there was not such a deep interest in nystagmus in connection with vestibular irritation as at present. A note was made, however, of the peculiar jerking of the eye. Ail despaired of getting



even fair hearing in that ear. This patient was seen four or five years ago. Dr. Duel saw the patient last year, and found that he had fair hearing and perfect equilibrium. He still at intervals takes what he terms his "cocktail" of iodid of potassium, one-half ounce doses. He took this several times a year for a period of some weeks. At the time when he had this very pronounced attack he had taken one and a half ounces a day of iodid of potassium for several weeks.

DR. ALDERTON said he had under observation a boy, thirteen years old, who had been taking for quite a while one and a half ounces of the iodids, which he tolerated very well. At last, however, he had to stop these large doses because of considerable irritation of the nasopharyngeal mucous membrane, tube and middle ear. The patient recovered from all these upon stopping the iodids.

DR. QUINLAN said that, apropos of the discussion on syphilis, he had a patient under observation who came to him two years ago ataxic and with a very obstinate lesion of the internal ear. He was so absolutely deaf he had to give up his business. He was assisted in walking by members of his family; he was unable to do anything at all, and he despaired of ever being able to return to business. Unguentum hydrargyrum, in half-dram doses, was given by inunctions according to the classical plan, each night, employing the inunction on different portions of the body. He came for observation every two weeks. At first he could hear the acoumeter at one foot, whereas now he could hear it at fifteen feet. He was also given seventy-five grains of iodid of potassium three times a day. Every other night the patient took a hot bath. This patient had been absolutely deaf for two years, and had to abandon everything during that entire period. His hearing was now restored, his ataxia was greatly improved, and he had been restored to health and able to look after his business by this vigorous treatment. Dr. Quinlan thought that sometimes we despair of these cases, but by giving the patient full doses of this sheet anchor improvement takes place. In this patient the administration of such large doses of the iodids, together with the inunctions of mercury, not only did away with the pseudoataxia, but reestablished the other physiologic conditions. The consideration of cases of this kind was well worthy of their notice.

DR. TOEPLITZ asked Dr. Duel in what stage of syphilis his patient was.

DR. DUEL replied, in the tertiary stage.

DR. TOEPLITZ said that in 1893 he published a paper in which he reported the case of a man in which syphilis was discovered after an examination of the ear and the hearing. The patient was a physician who walked into the hospital and asked that his ear be examined. Dr. Toeplitz found a considerable lowering of hearing in the left ear, but could not make the case out. After two days the hearing in the other ear became lowered. Examinations were made with tuning forks. The patient lost the high notes, and this made him suspicious. Dr. Toeplitz asked the doctor if he had other signs of syphilis. He learned that the doctor did have a primary lesion of the middle finger of his left hand. Upon further inquiry he found that in the gynecological work of the colleague patient, examinations were made with the left hand, and in this way syphilis has been contracted during such examinations. He appeared to be in the second stage of the disease. The case was published in the *New York Medical Journal* in 1893 as one of the earliest cases of otitis interna in the course of syphilis.

DR. DUEL wished to add that they need not despair of their treatment in these cases of syphilis. One particular man he referred to was an eminent surgeon. He had despaired of the man's life; and in view of the remarkable success that had attended the exhibition of large doses of the iodids in syphilis, the man was asked to practically drink iodid of potassium—pitchers of it. Only last year he had the pleasure of sitting at this man's table. He was now a surgeon and at the head of a hospital. He played golf and was in perfect health.

#### Case of Brain Abscess.

DR. JAMES F. MCKERNON presented a patient upon whom he had operated for brain abscess February 9th, eight years ago, when she was twenty-one years of age. This abscess was upon the left side, and apparently was the result of an attack of purulent otitis following measles, which she had when she was one year old. For five years she had gone on without any apparent trouble except an occasional outbreak of discharge from the ear. The lower part of the drum membrane was absent and showed the lining membrane of the tympanic wall.

Here was a woman, twenty-one years of age, who had a purulent discharge from the left ear following an attack of measles. On the 8th of February, when Dr. McKernon saw her, she was in a state of stupor; she could be aroused, and then would moan a great deal and gritted her teeth. Her hands were closed, even clenched. There was intolerance to light. The pupils were negative.

An examination of the external auditory canal showed it to be plugged with a large polypoid mass, which was bathed in thick greenish secretion of a very foul odor. A tentative diagnosis of brain abscess was made. The temperature was  $97.2^{\circ}$  and the pulse 52.

Dr. McKernon again saw her the following day in consultation, when she was decidedly in a state of stupor, advised operation, which was done that same afternoon. He found a large cholesteatomatous deposit in the mastoid antrum. There was a perforation through the antrum in the middle fossa, and there was also a perforation up through the zygoma and roof of the tympanum. The middle ear was practically filled with this cholesteatomatous deposit. He enlarged the opening posteriorly and made a large oval window between the attic and the mastoid cavity, cutting away a portion of the posterior wall. The dura was markedly darkened. When he removed the bone and exposed the dura, the dura bulged into the opening. He then enlarged the opening anteriorly, completely across to the angle of the eye and well back, thus exposing the temporo-sphenoid lobe at its lowest level and as far back as its posterior tip. He evacuated a large amount of pus from this brain abscess. There was a distinct lining membrane to this abscess cavity.

Instead of using the method he formerly employed, irrigating the abscess cavity with normal saline solution, he simply separated the parts with two blunt retractors, and mopped out the abscess cavity with sterile gauze, and then inserted two drains of gauze. These drains were inserted to the deepest part of the abscess cavity. For ten days the patient made an uneventful recovery; then she had a slight rise of temperature to  $100.5^{\circ}$ , she became irritable and restless and her pulse, which had been 90, fell to 62. The examination of the eyes was negative. Dr. Rae was present, and believed that this was a case of multiple brain abscess. The retractors were



again passed in; blunt forceps were inserted into the posterior portion of the wound, and half an ounce of pus was evacuated. This pus was not foul in character, showing it was of recent origin. No multiple abscess cavities were found. The wound was dressed again in the same manner as at the first operation. After ten days the drain was withdrawn one-half an inch at each dressing until the sixth day, when it was entirely removed. Then a small wick was passed in. The patient then made an uneventful recovery, with only occasional attacks of vertigo.

There had been a great deal of criticism as to the best method of draining such abscess cavities, whether they should use sterile gauze in removing the pus or employ irrigations. He thought, however, that most men to-day used the dry treatment in such cases. The point he wished particularly to emphasize was that in the repair of these abscess cavities it was not wise to handle them too much at the time of the operation or at the subsequent dressings.

#### DISCUSSION.

DR. GRUENING said that it had been maintained by most men that the proper thing to do was to drain such abscess cavities. He could see no reason why there should be any objection to employing direct drainage from below. The abscess cavity should not be syringed, but should be treated dry. This was the plan he followed. Dr. Gruening asked if there was an optic aphasia in the case reported.

DR. MCKERNON replied that there was none whatever. Most of the destruction was in the anterior portion of the temporosphenoidal lobe.

DR. GRUENING said that recently he had been called to see a case. The patient was a man, with a temperature of 105, but this varied greatly, sometimes being normal and then again going to 105. With the high temperature he had a pulse of 80. He had optic aphasia. When he was shown a watch and was asked what it was, he would reply that it was to tell the time, but he would not say it was a watch. When he was shown a pencil and was asked what it was, he would reply that it would write, but he would not say that it was a pencil. Operation was performed, and an abscess of the temporosphenoidal lobe was found. This was treated by the insertion of a gauze drain.



The patient got well of the abscess, but the temperature remained high. Then the sinus was explored. The blood culture was negative, but a negative blood culture did not, in his opinion, tell the story. The sinus was found to be filled with pus. After its evacuation, the patient made a good recovery.

In this case there was a combination of sinus thrombosis and an abscess of the temporosphenoidal lobe. Optic aphasia was very pronounced in this case. These patients with optic aphasia speak fluently of things what they do not see, but are unable to name the objects held before them.

#### **Presentation of a Noise Producer.**

DR. WENDELL C. PHILLIPS presented this instrument. Neuman had devised a noise producer which was operated by electricity. The one presented had to be wound up, and served the same purpose.

In the case presented by him, the girl could hear bone conduction in her left ear; but she could not hear ordinary sound.

Neuman's instrument was a more elaborate one and more useful instrument for testing patients for deafness.

DR. GRUENING asked what it accomplished.

DR. PHILLIPS replied that it absolutely cut off all sound.

DR. DUEL called attention to the method of making a diagnosis of complete deafness on one side.

#### **A Case for Diagnosis.**

DR. HENRY A. ALDERTON asked for aid in diagnosis. At the Nassau Hospital, on the 10th of this month (November), a girl of about eleven (11) years was operated upon under his supervision for cholesteatoma of the middle ear. The operation was quickly and well done, and a perfect view of the horizontal semicircular canal was obtained. A small area over the promontory showed the presence of granulations. The bone was intact and very hard. There apparently was no fistula. For three days after the operation the child did well, but on the fourth day she developed a temperature of 102.2. The temperature dropped the next day to 100, and again it went to 102. The next day it was 99.2, and again it rose to 101.2. The temperature then, with slight variations, rose to 103.6. The child complained of soreness of the sternocleidomastoid muscle. Otherwise she seemed to be in fair condition. At times

she had a little headache. The pupils were normal. Her general condition was fairly good. The wound was dressed a number of times and looked fair. The posterior wound was stitched at the initial operation. There did not seem to be any tumefaction around the wound, still the stitches were removed and the wound redressed. The temperature kept along about 103 plus, up to 104, but it did not drop to normal. The patient was gone over carefully by the family physician, and nothing wrong was detected except a heart murmur, which had not been found before. Two internes had examined the patient before the operation, and they were not able to tell whether the murmur was present or not. This temperature continued until the twentieth, when it rose to 104.4. The blood count varied. The percentage of hemoglobin was 92.75; the white cells numbered 12,800. The differential count showed the polymorphonuclears to be 67.1% and the transitionals 6.2%. Not having been able to find any apparent reason for the temperature except by exclusion, and, thinking there might be some trouble in the sinus, he uncovered the sinus nearly to the jugular bulb, and found conditions there normal. After this operation the temperature ran up again and was now 104. The child now for the first time showed evidences of a pneumonia.

The question arose whether this was a septic pneumonia or a central pneumonia. The length of the case with such a temperature before the development of the pneumonia seemed to preclude the idea of a central pneumonia.

DR. GRUENING thought this was a case upon which light could be thrown by means of a blood culture. If there was a positive blood culture, likely there was something in the jugular bulb or in the sinus. These were the cases where the taking of a blood culture was very useful. He also thought it was rather doubtful whether it was advisable to close these wounds; in such cases he believed the wound should be kept open.

He said he would like to know what treatment the other gentlemen would have employed; whether it was customary with them to close such wounds immediately or not. He had come to treat these cases of cholesteatoma as open wounds.

DR. ALDERTON said the cholesteatoma seemed to have been confined to the antrum and middle ear. It was two years ago

that Dr. McKernon had laid particular stress upon the discoloration of the bone over the sinus in such cases, in the discussion of a case, reported by Dr. Alderton, in which such discoloration existed, and which was operated and found to have a thrombosis. When they came to scrape away the granulation tissue they found the bone absolutely healthy. After taking away the inner table the dura appeared with normal gray color. He had not seen a case of jugular bulb infection without discoloration or thickening.

DR. GRUENING said he took exception to the statement; he did not think the appearance of outer wall always indicated the condition of the sinus.

DR. DENCH said that it was his practice to close the wound over cholesteatomatous cavities. If the cholesteatoma was thoroughly cleaned out, he could see no reason for not closing the wound. He never had any bad results following this course.

DR. GRUENING said that when a cholesteatoma was invested with a membrane, this membrane penetrates into the interstices of the bone and was difficult to remove, and there was likely to be a recurrence of the condition. Better results were obtained by the open wound than if the wound was closed at the time of operating. Of course the treatment lasted longer, but the results were better. Dr. Gruening had seen recurrences of the cholesteatoma when the wound was closed.

DR. MCKERNON spoke of the difficulty in determining whether or not there was a blood current in the sinus. He had met with two such cases during the past year. One was with Dr. Whiting; he operated last spring, uncovered the sinus, because of an irregular septic pus temperature. Nothing whatever was found, although he uncovered the sinus at length. Dr. Whiting said it did not look involved. However, it was incised, and it was found that no blood whatever came from it, and he extracted a large clot. He said he had seen two other similar cases, both occurring in children under six years of age.

With regard to the open wound in cases of cholesteatomata, if one thoroughly cleaned out the mass, then the wound should be closed. He usually closed such wounds and had had no reason to be dissatisfied.

DR. DUEL said that in these cases of cholesteatomata few were able to get all the masses out, no matter how thorough



an operation was done. One should not make it an absolute practice to close these wounds; if they did, they would make a mistake, although he had scraped out such masses, closed the wound, and with good results.

DR. TOEPLITZ believed that in cases of cholesteatomata, leaving a permanent opening was better than closing the wound at once. One patient who had been coming to see him for about five years had two mastoid operations performed by others, nine and thirteen years ago, respectively; on the return of the cholesteatomatous condition, he was successfully operated with a permanent opening, and now, after five years, refuses to have the wound closed.

DR. GRUENING said that the immediate results in these cases were not at all satisfactory. His own cases had interested him very much. He learned more from his failures than he did from his good results and successes. In a number of cases he had failed when he made an immediate closure of the wound, and that led him to treat his cases by the open wound, although this was not quite satisfactory to the patient at the time.

DR. LEWIS said that if the radical operation in cases of cholesteatoma was performed so as to leave no ridge between the external auditory canal and the excavated mastoid cells, and the meatal opening was sufficiently large, these cases could be managed as well if not better than through an opening back of the auricle, without the disadvantage of disfigurement.

DR. DENCH asked Dr. McKernon if the sinus aspirated on inspiration.

DR. MCKERNON replied in the affirmative, and said that in these cases it was very marked.

DR. MCKERNON said there was a very large area of pachymeningitis present in the case.

DR. ALDERTON asked if it involved the sinus wall.

DR. MCKERNON replied that it was in the middle fossa.

#### **Removal of Inner Plate Covering Middle Fossa and Outer Table of Temporal and Parietal Bones.**

DR. ROBERT LEWIS, JR., reported the case of a child who was brought to him about eight weeks after the beginning of an acute purulent otitis media. He found the drum membrane intact, but there were granulations on the posterior wall of the canal just within the meatus, and a sinus which led into the



mastoid cells. At the time of the operation the mastoid was found to be extensively involved, and it was necessary to remove the inner plate covering the middle fossa, as also the outer table of the temporal and parietal bones almost to the parietal eminence. Apparently there was no disease in the middle ear at all; a mass of granulations apparently sealed off the entrance from the mastoid cells into the tympanic cavity.

DR. LUTZ said he had had a similar case. A boy about three and a half years of age, with a history of having had a discharge from the ear for one year. On examination the drum membrane was found to be intact, but there was a small carious spot on the posterior wall; upon probing this, the instrument passed through into the mastoid cells. The mastoid was opened and found to be extensively necrosed. He could not understand how the child could have the condition without complaining of earache. There was a great destruction of bone. He did a radical operation upon him. There were no middle-ear symptoms. The discharge came through a perforation in the posterior wall.

DR. DENCH asked if the perforation was close to the ring.

DR. LUTZ replied that it was nearer the ring than the meatus.

DR. LEWIS said that in his case the perforation was just within the meatus.

**Invasion of the Mastoid Cells by *Diplococcus Intracellularis* With Formation of Pus.**

DR. STEPHEN H. LUTZ said he wished to make a report of three cases.

CASE 1.—This patient had a chill on a Friday, and on the following Sunday night both drum membranes were bulging, and both were opened that same night. She had a temperature of 104, and extreme pain. She begged for an operation, but the family was opposed to it. She was taken to the Brooklyn Eye and Ear Hospital Monday. A careful examination disclosed a pneumonia of the left lung. Nevertheless she was placed upon the table, and both mastoids were opened. No pus came from either mastoid. There was some bulging and edema over both mastoids. Although there was no pus present, the mastoids were filled with a thick, sticky mucus. Smears from this showed *diplococcus intracellularis* and *pneumococcus*. This patient made an uninterrupted recovery.

CASE 2.—This patient was a boy, who gave the history of a chill and an earache of three days' duration. The chill occurred on a Saturday, and the drum membrane ruptured Wednesday morning. That same evening the opening was enlarged. At that time there was an outstanding ear. No pus was found in either the mastoid or in the antrum. Smears here, too, showed the diplococcus intracellularis. This patient got well and left the hospital in five days and was absolutely well in ten days.

CASE 3.—This patient was operated upon by the interne. There was a bulging of the drum membrane, extreme tenderness, no chill, outstanding ear and an extreme earache. The drum membrane was incised. There was no pus in the mastoid cells. The wound was at once closed and an uninterrupted recovery followed.

In these three cases the diplococcus intracellularis was found. He asked if those present thought he had opened healthy mastoid or not. Two were typical mastoid cases, with bulging drums and outstanding ears. All went to operation mainly because of the pain.

#### DISCUSSION.

DR. DENCH asked if there was any pus present.

DR. LUTZ replied that both mastoids had the cells filled with a thick mucus; no pus. In one case the periosteum was adherent.

DR. DENCH asked what was the color of the cells.

DR. LUTZ replied that they were not necrotic.

DR. DENCH asked if they were black.

DR. LUTZ replied no.

DR. DENCH said that if the diplococcus intracellularis was present, there was infection. This was rather a bad germ to find. Since there was infection present, he said he would not have been inclined to sew the wound up.

DR. LUTZ thought such a case would be a bad one to allow to go on.

DR. GRUENING said that he had practiced in the premastoid days, and it was wonderful how many of these cases got well without an operation. If such cases got well without operation in former years, why should they not get well now?

DR. HARRIS asked if pus was found after doing the paracentesis in the case of the nurse, Case No. 1.

DR. LUTZ replied that the pneumococcus was found in the

discharge from the ear, but the diplococcus intracellularis in the discharge from the mastoid. No pus at any time.

DR. McKERNON asked if there was any encroachment upon the canal itself.

DR. LUTZ replied that there was a bulging of the wall, in two out of the four mastoids.

DR. KENEFICK asked if the condition then cleared up.

DR. LUTZ replied that the ears were still running when the stitches were removed. The discharge from the ears lasted longer than from the back, but only about a week longer.

DR. KENEFICK believed that Dr. Lutz did well to operate early in his three fulminating cases.

DR. GRUENING asked what the temperature was.

DR. LUTZ replied that in the first case the chill occurred on a Friday, three days before the operation. The patient had a temperature of 104, but the chill and temperature both were due to the presence of the pneumonia, he thought.

In the second case there was a great deal of swelling above the ear. This patient had a temperature of 102.4.

The third patient had a temperature of 101.2.

DR. DUEL said that it was unusual for him to meet with these outstanding ears as such an early symptom, unless the infection had extended through the posterior canal wall. In cases of mastoiditis, except occasionally in infants, they were not met with except in the later stages. He asked if the condition was not due to a periostitis which developed from the external canal.

DR. LUTZ replied that he was absolutely sure that in none of the cases was there an infection of the canal or external ear. There was no furunculosis. The outstanding ears in all the cases were marked. In one case there was a patch of edema present.

DR. KENEFICK believed that the postaural glands were affected early in these cases, especially in children.

DR. GRUENING said that he knew from the material he had had at the Mt. Sinai Hospital the glands were involved in cases of otitis and postauricular swelling. It was due to the irritation of the skin. These patients were not clean; they had pediculosis, which caused a dermatitis, and this was accompanied by glandular swelling. Whenever he saw such swelling, he first examined the head.

DR. LUTZ said he had had experience in the same way.

## NEW YORK OTOLOGICAL SOCIETY.

*Stated Meeting, January 25, 1910.*

JAMES F. MCKERNON, PRESIDENT, IN THE CHAIR.

### **Mastoid Operation With Blood-Clot Closure.**

DR. WENDELL C. PHILLIPS presented one patient and cited the cases of two others upon whom he and Dr. J. J. Thomsen had performed the mastoid operation with blood-clot closure of the wounds. He was on record as being not very much in favor of the operation, but in the cases reported the results had been quite satisfactory. The patient presented, a woman, had been operated upon on March 27, 1909. She had had chronic otorrhea of long standing, with subsequent development of mastoiditis. The wound healed by primary union and there has been no return of the trouble. The second case, operated upon ten days ago, was one of acute mastoiditis. The wound closed promptly. There had been no subsequent discharge from the canal. The third case, a little child, was operated upon two weeks ago at the New York Post-Graduate Medical School and Hospital. She had had mastoiditis about six days. There had been a good deal of pain and a profuse discharge, but no external swelling. The purulent involvement was not very extensive, and as the operative field was comparatively small the blood-clot method of closure had been employed. The wound was a very dry one, necessitating the making of incisions into the soft tissues of the wound in order to secure sufficient hemorrhage to close the wound. A cigarette drain was inserted, and this was drawn out a little each day until the wound had closed. At the end of 14 days only a small granulation remained of the post-auricular wound, which was snipped off, and three days later final healing had taken place.

### DISCUSSION.

DR. EMIL GRUENING expressed interest in the cases, but could not accept them as cases of mastoiditis. In many years he had not seen a case of mastoiditis that could be closed in



this manner. If operated upon early enough, before the development of mastoiditis, the wound would close. He had never seen a diseased mastoid without hemorrhage. Despite the reports of the brilliant results of Dr. Blake, Dr. Reik and Dr. Sprague, he was still skeptical. He did not believe that the wound in true mastoiditis could be closed in this way.

DR. ARTHUR B. DUEL had operated upon a patient two years ago and had closed the wound by the blood-clot method. Within fifteen days after the operation the woman returned to the hospital with sinus thrombosis, from which she died. Theoretically he had been opposed to the idea of the blood-clot closing of a septic wound, which could never be thoroughly cleaned, especially as the advocates of the method claimed that antiseptic solutions interfered with the phagocytic action of the blood. Hearing, however, of cases in which the operation seemed favorable, he had tried it in the case cited. The wound healed by primary union, and in seven days the patient was apparently cured. A week later she returned with the sinus thrombosis, and, despite prompt tying, and excision of the jugular vein and sinus wall, the patient died. This was a sad confirmation of his previous feelings with reference to the method. The speaker asked if the members of the Society would be willing to have the operation performed upon themselves. The answer to the question was negative.

DR. JOSEPH A. KENEFICK asked if an attempt was made, in cases in which this method was employed, to render the wound free from microorganisms. In acute cases the middle ear is a source of infection which could not be eradicated, and he would like to know if any attempt was made to accomplish such eradication.

DR. LEWIS A. COFFIN had employed the blood-clot method two years ago in a case of chronic suppurative otitis media which had been discharging for twelve years. The mastoid was not infected. The method in this case was a perfect success, the patient leaving the hospital in eight days with the ear perfectly dry. He had also operated by this method upon an acute case. The patient in this instance was well within two weeks.

DR. GRUENING called attention to the fact that it is necessary to eliminate cases of chronic suppuration of the middle

ear and attic from the present discussion. Such cases could easily be closed by this method because of the drainage through the canal. These, however, were quite different from cases of acute mastoiditis.

DR. MCKERNON asked Dr. Phillips if the blood clots were primary in the cases reported. If a drain is employed it is not a primary blood clot. He recalled a case reported to this society in which he had closed the wound by blood clot in acute mastoiditis in a man twenty-seven years of age. Five days later the patient showed all the evidences of sinus thrombosis. He opened the wound and found a clot in the sinus and in the vein.

In reply to a question by Dr. Dench he said that he did not know whether the sinus thrombosis was due to the blood-clot closure of the wound, or whether it was merely a coincidence. He had attributed it to the method of closure of the wound.

DR. GRUENING said there might be sinus thrombosis with fatal termination without a blood clot, due to infection. The same may be true when the wound is closed, particularly without drainage. He considered the operation unsurgical, and consequently he had never performed it. He would not sew up an abscess in the soft tissues; why, then, should he sew up a bone abscess?

DR. DENCH had had a certain number of cases in which there was a reaction after closure. In this connection he cited a case of subperiosteal abscess, which, however, made a complete recovery. The result in cases operated upon in this manner is entirely uncertain. A great deal of danger attends the complete closure of the wound.

DR. PHILLIPS, closing the discussion, emphasized the fact that this operation is applicable only in cases where the disease is not of long standing and not extensive. Before closing the wound he had cleansed it with physiological salt solution. Ordinary sutures were used, except in one or two cases, in which subcuticular or Michel's metal sutures were employed. He considered the method unsurgical in cases where there was pus in the posterior cells or where the involvement was extensive. He agreed with Dr. Dench in the matter of drainage. He had used the cigarette drain in only one or two cases. In the last two years they had recorded

eleven cases, in not one of which had the wound to be re-opened.

#### PRESENTATION OF APPARATUS.

##### **The Vacuum Cleaner—Its Applicability in Routine Office Work and in Operative Work for Sponging. Description of Apparatus.**

DR. W. H. HASKIN: For the past seven years I have used suction so constantly in my office it has never occurred to me that others have not found its great usefulness also, but find that my confreres, in New York at least, have not made use of it. The results obtained when used are so immediate and the ease of handling the apparatus is so simple, I think that a simple demonstration of its ability to suck up a raw egg will prove that it will remove any secretion that one will find in the throat or nose. Its applicability rests not only in our daily office work, but it will also be found to be of the greatest service in operative work, both upon the mastoid and in many nose and throat operations. In fact, with proper catheters, I believe that there is a very wide field for its use in general surgery, especially in abdominal work. Vacuum cleaning is being used very extensively in the household; why not apply it also to the body?

I have used the pump of the Wappler Company and that of the Victor Electric Company, and the only addition I have made is the insertion of a bottle between the pump and the site to be cleaned. This secures a constant, uniform suction and prevents the material removed from entering the pump and thus interfering with its action. By having catheters of various sizes one can always reach the secretion, wherever it may be. I have always used the soft silver eustachian catheter, of various sizes, but have suggested to the Wappler Company and the Victor Electric Company that the catheters be made smaller at the tip and gradually enlarged back to the end which is inserted into the rubber tubing, and they are preparing such catheters, with obturators, in three sizes. This will lessen the possible blocking of the tube, as anything that will pass through the tip opening will pass into a larger area at once. If any one will use the apparatus a few times, until he becomes accustomed to it, I feel sure that he will be gratified, and if used regularly it will become invaluable.

With this apparatus the treatment of all suppurative cases



is greatly simplified, for the perfect removal of all secretions leaves the membrane clean for the application of whatever medicament you may wish to use, and you may feel sure that it is not neutralized by the secretions themselves. The edematous conditions caused by the membranes being constantly bathed in these irritating secretions will generally quickly subside, because the action of the drug used is so much more certain. Patients who have been accustomed to syringing and the cotton applicators are invariably delighted and notice the much greater relief afforded at once.

Cases of pansinusitis are especially suited for its use, and I know of nothing that will so thoroughly clean the cases of atrophic rhinitis, although the thick crusts may have to be softened first. In the throat it can be used for removing the secretions in the tonsillar crypts, and it is especially useful in removing the thick, ropy secretions which adhere so closely to the posterior pharyngeal wall and the base of the tongue. The relief afforded in emptying the cavities of peritonsillar abscesses is immediate and aids materially in cutting short the distressing symptoms. In fact, it will clean out any abscess cavity better than any other method that I have ever used. In suppurations of the ear, I cover the tip of the catheter with very small, almost capillary, rubber tubing, which lessens the danger of hurting the patient if he moves suddenly. You all know how difficult it is to thoroughly remove the thick mucopurulent secretions of the ear by syringing or wiping, and will be gratified with the ease of its removal with suction. By using suction, with the Siegel otoscope, after all visible secretions have been removed, one can quickly see just where the secretion comes from and can apply treatment more successfully in most cases. I would like to suggest here that all give a thorough trial of the lactic acid bacillus in the treatment of suppurative ear cases.

I have been using this apparatus in my mastoid operations for sponging, and find that it not only shortens the length of the operation, for you do not have to wait to have the field cleaned, as the suction can be used constantly right at the site where one is working, but also, that when working down in the attic or middle ear, by holding the catheter in the left hand, the operator can secure a perfect field of vision and need have no fear of injuring the foramina or any other dangerous



point, and can work much more rapidly. In the after-treatment of these cases it is of the greatest possible value, for with it one can quickly remove all secretions in the attic and in the middle ear without injury to the delicate new granulations and without pain to the patient. In tonsil and adenoid operations, a little experience will enable the assistant to keep the throat perfectly clean, without necessitating the turning over of the patient or any sponging, and it removes the danger of aspiration of blood and secretion. After the operation, by inserting the catheter into each nostril, all blood and clots can easily be removed from the nose, and the patient is relieved of much of the discomfort which often follows the operation because of the blocking of the nose, and also there is much less nausea, the blood being kept out of the stomach. I have never used it in nasal sinus operations, except on the antrum, where it is invaluable to me, for I have yet to find a case in my private practice where operation was necessary after carefully using suction, sometimes using it twice daily for a short time. In cases where the operation is necessary, because of necrosis, I believe it would prove to be a great aid, not only in the operation, but also in the after-treatment to remove secretions. The catheter can be sterilized, and the fingers cannot, without prolonged scrubbing and washing with antiseptics, and you can readily see how much danger of infecting recent wounds is lessened. I believe that it would prove to be of the greatest value in general surgery, especially in those abdominal cases with abscess cavities, where the danger comes from the infection of the peritoneum. The suction will remove the pus absolutely and rapidly. In ordinary office work it is well to keep the vacuum bottle half filled with a strong antiseptic solution. I use a 1 per cent solution of formalin, and to have the glass tube which is connected with the catheter reach the bottom of the bottle. By this means one is able to reverse the pump and thus force out the secretion and at the same time sterilize the tube. After the secretions have been driven out, it is well to again immediately reverse the pump until you see the air bubbles passing through the water in the bottle. This will keep the water from escaping on the floor. In operative work the tube should be raised above the solution, otherwise the albuminous matter, drawn into the bottle, will quickly be

churned into froth by the air bubbles and, being drawn into the pump, will cause trouble.

In office practice the pump should be placed so that the control and the reverse can be easily reached, and the tube should be long enough to reach your cuspidor, so that it can easily be emptied. In operative work the bottle should be placed near the site of the operation and the tube be relatively short, so that there will be less danger of clotting and thus blocking the tube. I have never had this happen, but there is a possibility, and this need not be taken by simply shortening the tube and keeping it fairly straight. Any pump that will produce a vacuum can be used, but this, which is one of the Wappler Company's earliest inventions, is particularly useful because of the ease with which one can reverse the current and thus keep the tubes clean.

DR. DUEL had used the apparatus once, but from this small experience was favorably impressed. He believed it would prove useful in mastoid work, particularly when canulæ were devised which would fit into the bottom of the wound without interfering with the instruments. It cleansed the wound much more quickly than could be done with sponges, and more effectually. It will accomplish in half a minute what it requires five minutes to do with sponges in abdominal work. When perfected he believed it would have a large field of usefulness in general surgery.

DR. STEPHEN H. LUTZ said he had used a Divilbiss compressed air aspirator, which, instead of spraying, as does the ordinary atomizer, reverses the air current and sucks any fluid back into the bottle. He had used this arrangement for a number of years. He had found it useful in sucking material from the eustachian tube. It can be used to clean out the nose, accessory sinuses, blood, etc., working as a suction or vacuum cleaner. This aspirator has been in the Divilbiss list for at least five years. The same thing can be done by the Victor transformer with massage pump, Pyncheon model, which gives constant or interrupted suction from two of its four valves.

DR. DENCH thought the suction pump a good thing for removing the air from under the graft in skin grafting.

**Puzzling Case of Otitis Media Involving Differential Diagnosis Between the Eruption of Streptococcemia and That of Iodoform.**

DR. EDWARD B. DENCH cited a rather puzzling case of otitis media which had come under his observation in the New York Eye and Ear Infirmary. Myringotomy had been done rather imperfectly. The temperature was  $101^{\circ}$ ; there was no mastoid tenderness. During the afternoon the temperature rose to  $102^{\circ}$ . When he saw the patient the next day the temperature was normal. He asked that the myringotomy be repeated; this was done, and the operation was followed by a rise in temperature. There was no tenderness over the mastoid at any time. The mastoid was opened and pus found. The wound was packed in the usual manner. That night the temperature went to  $105^{\circ}$ , and the next day there was an eruption covering the affected side of the face, a part of the chest, and gradually extending until it covered the extremities. On the morning of the second day the other side of the face and the inner aspects of the arms were involved. The eruption was papular in character, and some who saw it diagnosed it as measles. The speaker considered it a streptococcic infection. A culture was made, but no streptococcemia was found. The temperature dropped to  $102^{\circ}$ , then rose again. The house surgeon suggested that it might be an iodoform rash. The iodoform gauze was removed and the rash disappeared. After the diagnosis of iodoform rash had been made the mother of the patient said the child had an eruption of this kind every year. The differential diagnosis between streptococcus infection and iodoform rash was difficult to make. Another case which had come under his observation was that of a man who at times had sugar in the urine. In this instance both wounds were packed with iodoform gauze. Although there was no rise of temperature above  $101^{\circ}$ , the man became dull and stupid. The urine became very dark in color and showed the iodine reaction. The removal of the iodoform gauze was followed by a cessation of all untoward symptoms.

DR. HASKIN had reported two cases of iodoform rash two years ago. One, a small child, upon whom the radical operation had been performed, developed a high temperature, with evidences of meningitis, which disappeared on the removal of the iodoform gauze. In the other case, a man, the eruption



was thought to be erysipelalous. When the gauze was removed the rash disappeared. The reason for the frequent occurrence of iodoform rash is probably found in the careless making of the gauze and the use of too strong percentages of iodoform.

DR. THOMAS J. HARRIS raised the question as to whether it were the practice of the members present to use iodoform gauze, and whether as good results were obtainable with plain gauze.

DR. LUTZ formerly used iodoform gauze, but after an experience similar to that cited by Dr. Dench he had abandoned it. Dr. Lutz has used only plain gauze for the last six or seven years.

#### **Sinus Thrombosis With Negative Bacteriologic Findings.**

DR. FREDERICK WHITING recounted the case of a boy who had been brought into Mt. Sinai Hospital with a history of having had a discharge from the ear for three or four days, which discharge had suddenly ceased. The parents stated that the child had had two chills and had been apparently very feverish for two days. The middle ear presented an almost entirely negative field. The tympanic membrane appeared thickened, as if it had undergone a suppurative process from which it had recovered. In the anterior inferior quadrant there was a small hernia of the epithelial layer. The appearances of the fundus of the ear did not at all suggest a recent suppurative process, but the boy looked sick, and the temperature was  $105+^{\circ}$ . There was no mastoid tenderness whatsoever. There was, however, distinct tenderness along the line of the jugular. There was a certain amount of post-mastoid tenderness in the superior part of the cervical triangle. The child looked so sick and septic that it was decided to operate. A blood culture was made. The mastoid was opened, and appeared to be perfectly normal, so far as the macroscopic appearance of the cells was concerned. There was nothing to suggest any suppurative process in the mastoid at the time. The sinus was opened, and on its posterior knee was a small deposit of fibrin. Its area was not more than one-quarter of an inch in any dimension, and it was nearly circular. In clearing away the bone from about it the sinus wall, which was very thin, was pricked by a spicule of bone, or some little tear



was made in it; at any rate, it bled freely. The sinus felt perfectly fluctuant everywhere; there was nothing about the feel of it to suggest difficulty concerning its lumen. Bleeding from the vein was very easily controlled by pledgets of gauze. It was decided to wait and see what the blood culture would show. In the meantime the boy had another severe chill, lasting twenty minutes or longer, followed by a second. The fluctuations in temperature were somewhere between  $99^{\circ}$  and  $104^{\circ}$ . So far as the temperature was concerned, the picture was a typical one of an infected sinus. After eighteen hours the blood culture report proved to be negative. There was still tenderness in the posterior triangle. It was then decided to go in and open the sinus. Another blood culture was made, which also proved to be negative. The sinus was opened, and when this was done there was quite a gush of blood. In other words, the clot found toward the torcular side was parietal. But there was a clot extending well down into the jugular, and this clot had already begun to undergo disintegration. It was not distinctly purulent, but was well disintegrated. Back toward the torcular was a fibrinous clot. In cutting away the bone toward the jugular foramen it was found that the anterior wall of the jugular foramen was so shaped as to divide the foramen into two complete kidney-shaped foramina. A bony growth had developed from the anterior wall, dividing the foramen into two foramina. There was just a little space between the apex of this bony irregularity and the wall, so that it was almost as if there were two jugular veins. It was necessary to chisel away the bone before the clot could be reached. Dr. Libman was present at the operation, and the clots which were removed from the sinus were immediately put into gelatin, and were found to contain streptococci. The child was turned over, and the jugular resected to the level of the omohyoid muscle. The clot extended down not quite to the common facial. Ten days had elapsed since the operation, and the temperature had been practically normal since.

This case was cited in order to emphasize the fact that one is obliged to depend absolutely upon the clinical manifestations now just as much as one was ten years ago. A negative bacteriologic finding signifies nothing. A positive finding, on the other hand, is of the greatest assistance.

## DISCUSSION.

DR. GRUENING, in discussing Dr. Whiting's case, said the case bore out what he had maintained. In a series of ten cases which he had published, he had depended entirely upon the clinical manifestations. In three of the cases the blood cultures were negative, but he had proceeded, in spite of the negative findings of the bacteriologists, and had found the thrombus. This merely emphasized that one cannot depend upon negative findings, and that the clinical symptoms are much more reliable than blood cultures. A blood culture which is positive, however, was of material help. Positive blood cultures, in the experience of a number of men at Mt. Sinai Hospital, had cleared up the diagnosis, and in a number of cases a thrombus had been found in the bulb which could not be detected by inspection.

DR. DUEL had had a case quite recently in which, judging from the clinical symptoms, the sinus was involved, and in which a clot about an inch and a half long was removed. The blood culture was negative. The study of bacteremia in cases of ear trouble were still being pursued at the Manhattan Eye and Ear Hospital, and he believed that the whole subject would eventually be modified somewhat regarding the value of the presence of bacteremia in determining the necessity for operation. The undoubted presence of bacteremia would cause one to operate earlier; on the other hand, to have waited in the case cited would have been fatal.

DR. GRUENING called attention to the importance of knowing from which vessel the blood has been taken for the blood culture. If the blood had been taken from the sinus in Dr. Whiting's case, the streptococci might have been found, but at Mt. Sinai Hospital the blood is generally taken from the median vein. The question is not whether the streptococci are in the sinus, but in the circulation.

**Sinus Thrombosis; Streptococcus Capsulatus in the Blood.**

DR. JOHN E. SHEPPARD, of Brooklyn, cited a case which had been under treatment by another aurist for five or six weeks. When first seen, it seemed to him, judging from the history and symptoms, as if the sinus had been infected about four days previously. Operation was undertaken four hours

later. The man, who was about 60 years old, was profoundly affected by the germs circulating in the system. A very much infected clot was found. The jugular was tied—he did not have time to dissect it out—the patient having become virtually pulseless, in spite of strychnin, saline enemas, etc. He ordered a vaccine to be made from the patient's blood. The germ proved to be the streptococcus capsulatus. Thirty-six hours later some streptococcus capsulatus vaccine was obtained from Hoagland laboratory, and the patient was given a dose, with seeming effect. The man died three days later. Owing to some delay in the hospital service, the autogenous streptococcus capsulatus vaccine was not received until after the patient died. The pathologists claim that it is necessary, at least in streptococcus infection, to employ an autogenous vaccine. In this case, however, even that might not have saved the patient.

DR. GRUENING said it had been demonstrated that in these cases of bacteremia due to otitic disease ligation of the jugular vein is necessary. He had reported several cases in which streptococci had been found in the blood, but the germs disappeared after tying the jugular. From this it would seem to be of more import to tie the jugular than to inject streptococcus serum. Some cases in which streptococci were found recovered, and some in which they were not found did not recover, so he had learned that the pressure of streptococci in the blood did not render the cases of thrombosis of the lateral sinus more fatal.

#### Hiss Extract.

DR. JAMES G. DWYER, by request, told something of the work with the Hiss extract. This extract was obtained by centrifugalizing the leucocytes of rabbits and extracting in sterile distilled water. By this method the fixative and the cytase, together with the endobodies of the leucocytes, were obtained in a soluble form. Dr. Hiss had reported twenty-four cases of epidemic meningitis and also a series of cases of pneumonia, treated by this extract. The speaker had employed it in seven cases. In one case, following a mastoid operation and jugular resection for acute mastoiditis and sinus thrombosis, the temperature continued to be of a septic character, varying between 103 and 106, for eight days. At this time treatment with the extract was started, and within a few hours



the temperature fell two degrees. Within the next few days it gradually fell to normal, and eventually the patient returned home well. In another case, pansinusitis following the radical Killian operation, the temperature continued to be of a septic type, and for fifteen days fluctuated between subnormal and 105. On the fifteenth day 10 cc. Hiss extract was injected, and following this the temperature fell three degrees within a few hours; after one more injection of the same dose, the temperature became normal and remained so. There were corresponding drops in the pulse rate and the respirations, and the whole general condition was improved. Well-marked symptoms of meningitis were present in this case. The recovery was uneventful.

Dr. Dwyer said that Metchnikoff has shown that the leucocytes give rise to the fixatives and the cytases. These are supposedly extracted in the Hiss extract and are available for immediate action. This extract is thus independent of the organism causing the infection. There are many varieties of streptococci, hence the necessity of using an autogenous vaccine. In Dr. Sheppard's case, following the injection of such a vaccine, the body would be in a state of heightened susceptibility to the infection for some days, the length of time depending on the dose and the reaction of the body. This is the negative phase. It is better, in the speaker's opinion, to use the leucocyte extract in the very acute cases, confining the use of vaccines to the chronic cases or to the locally acute forms.

DR. HARRIS believed serum therapy to be one of the most important questions which had arisen in years. He was glad Dr. Dwyer had taken up the matter and hoped his studies would result in something definite. Conclusions could not be reached from the few cases reported up to the present time, nor could one, at the present state of knowledge upon the subject, hope to depend upon serum therapy to the exclusion of operative procedure. It would be well, however, to reinforce operative measures by such methods as Dr. Dwyer had suggested. The question raised by Dr. Sheppard with reference to the necessity of employing an autogenous serum in order to combat ear troubles is quite apart from the subject under discussion. The leucocyte extract was quite different from the



antistreptococcic serum. Dr. Dwyer was asked to explain this matter.

DR. FRANCIS J. QUINLAN cited a case which had been under his care at St. Vincent's Hospital. The patient, a man, had had a discharge from the ear for seven or eight days, which, by aural inspection, had apparently healed. There was some tenderness over the emissary vein, sweats which soaked the mattress, and a septic temperature which fluctuated between 100 and 103 degrees. The body of the mastoid presented no symptoms of interest. An exploratory operation was advised and consent obtained after some delay. Before the patient had been taken to the operating room Dr. H. Biggs, who saw him in the ward and agreed that he was profoundly septic, asked the speaker if he had tried antistreptococcic serum. Upon this suggestion some of the serum was immediately obtained and injections given every day at first, then every other day. The temperature became normal, the sweats subsided, and the mental condition of the patient improved. The tenderness, however, persisted. A week had elapsed since the injections were begun, and there had been a complete transformation in the condition of the patient. The question presented itself as to how far the serum is potential without operative interference, and whether any serious infection in the vein would be eliminated by the antitoxic serum.

## ABSTRACTS FROM CURRENT OTOLOGIC, RHINOLOGIC AND LARYNGOLOGIC LITERATURE.

### I.—EAR.

#### **The Meaning and Treatment of Diseases of the Eustachian Tube in Connection With Inflammation of the Middle Ear.**

URBANTSCHITSCH, Wien (*Wien. med. Wochenschrift*, 1910, No. 2). Salpingitis chronica purulenta is quite commonly observed in combination with otitis media purulenta chronica. It can cause an otitis on the one hand or a tonsillitis on the other. By means of a catheter he washes out the tube, first with normal salt solution, and then by means of bougies covered with a 7-10 per cent solution of nitrate of silver he cauterizes the interior of the tube.

#### **Contraindications to the Tympanomastoid Exenteration in Chronic Suppurative Otitis Media.**

E. A. CROCKETT, Boston (*Journal of A. M. A.*, July 31, 1909). Except in the presence of meningitis or septicemia symptoms the radical mastoid is contraindicated in nearly all patients with double middle ear suppuration or with unilateral suppuration, and the hearing destroyed in the other ear. In an adult who has carried a suppurative ear for forty or fifty years operation is not advised until faithful middle ear treatment has been carried out for at least six months. The radical mastoid operation should practically never be done in children under five years of age.

It is contraindicated in all cases unless the operator is experienced in the surgery and anatomy of the temporal bone. There is always a chance of stopping the discharge and ultimately improving the hearing by ordinary tympanic treatment. In children this is especially true. Up to the age of five, local treatment failing, a simple operation is indicated, draining the middle ear through the antrum. Ryder.

#### **Mastoiditis in Scarlet Fever and Measles.**

HENRY A. ALDERTON, Brooklyn (*Long Island Medical Journal*, December, 1909). From July 15, 1907, to July 15, 1909, the writer had under observation 1621 cases of scarlet fever

and 2106 cases of measles. In the scarlet fever series, 178 cases (practically 11%) developed suppurative inflammation of the middle ear. Many of these developed mastoid symptoms, 47 (26%) requiring operation. Mortality, 25%. Among the measles 326 cases developed ear trouble (15%), 34 cases (10½%) requiring mastoid operations, with a mortality of 29%.

The mortality in the operated cases cannot be attributed wholly to the mastoid disease, but rather to the fact that in the great majority of the fatal cases other and serious complications existed—bronchopneumonia, nephritis, endocarditis, enteritis, etc.

The symptoms of otitis follow about the same type in the two conditions, with the difference that in measles they are apt to be less of the fulminating type, and there is not so much destruction of the middle and internal ear and of the neighboring parts.

As regards prognosis the complication of bronchopneumonia is especially unfortunate. In the 22 fatal cases in the two series bronchopneumonia occurred 14 times. The higher mortality in the operated cases in the measles series is accounted for by the greater prevalence of the inflammatory conditions of the respiratory tract.

Ryder.

#### The Physiology of the Eustachian Tube.

EDMUND PRINCE FOWLER, New York City (*Journal of A. M. A.*, July 31, 1909). Following a number of observations Dr. Fowler concludes that the act of swallowing increases the sound of tuning forks heard either by air or bone conduction.

If a tuning fork is vibrating strongly near or below the nostrils a marked increase in the intensity of its tone will be perceived in both ears during the act of swallowing. This increase lasts during the first part of deglutition, that is, while the tubes are open.

If the fork is held before the nostrils and the patient swallows at the instant when its note ceases to be heard, the sound will again become audible to him. This increase in sound perception is due almost wholly to the opening of the eustachian tube during deglutition.

If a vibrating tuning fork is placed in firm contact with the scalp, preferably over the lambda, a marked increase of the

sound will be noted by the patient during deglutition or tubal opening.

The increase in the sound of vertex forks during tubal opening is brought about by two factors: the opening of the communication between the middle ear and nasopharynx, thereby permitting increased perception by air conduction, and increased bone conduction due mainly to slight changes in the drum membrane.

Dr. Fowler has devised an automatic ear inflator for home use. He illustrates the same and describes the method of its use.

Ryder.

#### **Clinical and Anatomic Manifestations of Otitic Brain Abscess.**

ALFRED WIENER, New York (*Medical Record*, January 23, 1909), emphasizes the following points: If suppuration is still going on in the middle ear or contiguous parts and the diagnosis of complicating abscess is reasonably sure, it is well to bear in mind that in fifty-seven per cent of these cases the brain abscess and the suppurating ear are in direct communication. The remaining forty-three per cent of the cases are classified as metastatic abscesses, subsequent to the ear condition, but with no direct connection between the primary suppurative condition and the abscess. In about twenty-six per cent of the cases the suppurative process in the ear is still active.

Brain abscesses are at times latent and possess very thin walls. They may be situated dangerously near the ventricles or arachnoid space. In such cases, if the mastoid process is first attacked the necessary chiseling may lead to rupture of the abscess with rapidly fatal results. Latent abscesses may exist for a long time and become manifest after an ordinary trauma of the skull.

In the treatment of otitic brain abscess we should especially consider first its location; second, its duration, and third, its intimate connection with the existing suppurative process in the middle ear cavity.

Ryder.

#### **Symptoms of Intracranial Complications of Purulent Otitis.**

ARTHUR B. DUEL, New York (*Journal of A. M. A.*, July 31, 1909). Cranial involvement from acute purulent otitis is likely to be rapid, acute, accompanied by violent systemic dis-



turbance with localized symptoms; from chronic purulent otitis slow, distinctly localized, with slight systemic disturbance.

The lesions considered are inflammation of the meninges, inflammation of the brain, inflammation of the sinuses of the dura, and erosion of the internal carotid artery.

The symptoms arising from meningeal inflammation and those from collections of pus within the cranium are best appreciated from three points of view: systemic, due to toxemia; mechanical, resulting from cranial distension; and those resulting from pressure on a distinct or definite area of the brain.

Meningeal inflammation has three characteristic symptoms—headache, vomiting, and constipation. Following purulent otitis or mastoiditis these symptoms, with fever, and one or many of the indications of cortical irritation point unmistakably to meningitis. Lumbar puncture will throw much light on the nature of the infection.

Symptoms of pressure, headache, slow pulse, optic neuritis, change of size of the pupils, somnolence, while indicative of intracranial lesion, are not characteristic of any particular type or location. Localizing symptoms, when present, are frequently most definite in pointing to the position of an abscess.

A typical infective thrombosis of the sigmoid sinus gives a characteristic picture: chilly sensations or rigor, rapid rise of temperature (104 to 106), succeeded by as rapid a fall to normal and sometimes subnormal, sweating, all repeated possibly in a few hours or more. Mind clear.

Erosion of the internal carotid artery is extremely rare. The diagnosis is evident from the gush of bright red blood from the auricle.

Ryder.

#### New Method of Tuning Fork Testing.

BARANY (*Wien. klin. Wochenschrift*, No. 41, 1909). In carrying out the tests of Rinne and Schwabach the errors are as follows: 1. The amount of pressure made with the handle of the fork can cause an apparent difference in the length of the bone conduction. 2. The conduction is different at various points on the mastoid process. 3. The thickness of the overlying tissue causes differences in the time of the conduction. 4. The extraneous sounds in the room are an important

factor in the test. These disadvantages he has entirely eliminated by the following method: On the three ends of a T-shaped brass tube pieces of rubber tubing of the following lengths are fastened: For the ear of the physician a piece 66 cm. long, to the ear of the patient a piece 22 cm. long, and on the vertical branch a piece 88 cm. long is fastened. The ear of the patient is connected with the ear of the physician, and by means of the vertical piece the olive-shaped plugs in the ears are proved air tight by blowing through them. When they fit tightly the greatest amount of hindrance to the transmission of air waves possible is secured. If the fork is placed on the mastoid tip of the patient, and after he has ceased to hear the tone it is still heard by the physician, then there is a disease of the internal ear. The determination of deafness, due to transmission of the waves by the ossicles, is made by comparing the transmission of sound by means of the cartilage of the external ear and the bone conduction of the mastoid tip. A normal person is taken for the trial. The handle of the vibrating fork is pressed hard against the cartilage of the ear, and then lightly against the mastoid bone. The transmission of sound from the cartilage is much greater than the transmission of sound from the bone. The opposite conditions take place when the greatest pressure is made on the bone. By a little practice the same tone can be obtained from the cartilage as from the bone. When this test is carried out with low and middle toned forks, and the patient and physician hear the sounds alike, then there is no middle ear deafness. If, however, there is a middle ear deafness present, the conditions are entirely different. The physician notes no difference in the length of the two tones, but the patient notes a distinct shortening of the cartilage transmission, but not of the bone transmission. Even when the physician hears the tone louder from the cartilage than from the bone the patient hears the opposite condition. There seems to be no doubt that Barany has made an important discovery in this new test, but one must study the original paper carefully to understand how free from criticism the new test is. *Horn.*

#### A Specimen of an Encapsulated Brain Abscess.

H. P. MOSHER (*Boston Medical and Surgical Journal*, July 15, 1909). The patient, a man about 40 years old, was brought

into the Massachusetts Charitable Eye and Ear Infirmary unconscious. He presented the text book picture of brain abscess, unconsciousness, slow pulse and a beginning optic neuritis. There was no paralysis. Some three months before he had been operated upon for an acute mastoid. The operative wound had filled in, except for a small fistula. The usual operation was performed—that is, the antrum and adjacent territory of the mastoid were laid freely open. No fistula was found leading from the roof of the antrum to the cranial cavity. An opening was then made through the side of the temporal bone above the antrum. The dura was bulging and pulseless, and cutting through it the knife entered a cavity containing about an ounce of pus.

The cavity was found to run inward and forward for about two inches. It was drained, partly by rubber tubes and partly by gauze wicks. The next morning the patient was rational and better, but in the evening he was unconscious again and in bad condition. On the second morning the author redressed the abscess cavity and explored it with the finger. In the upper anterior part of the wound there was a bulging mass of brain tissue. In order to clean up the wound and make drainage better some of this was cut off and the top of an encapsulated abscess removed. The abscess sac was easily enucleated with the finger. An autopsy was obtained, and it was found that both abscesses were in the typical place, the acute abscess above the roof of the mastoid antrum, and the encapsulated abscess above the roof of the middle ear.

Neither abscess had a stalk, upon the finding of which Ballance lays so much stress. There was no fistula in the bone over the antrum, neither was there one in the bone over the middle ear, but the bone here was red and somewhat necrotic. This corresponds with the well-known fact that in at least one-half of the cases of brain abscess due to infection from the ear no bone fistula is found.

The encapsulated abscess was about the size of a hen's egg. It was found empty, with walls a quarter of an inch thick. The inner layer of the abscess walls consists of granulation tissue, next to this a layer of fibrous tissue and next to this, where the abscess came to the surface of the brain, the hemorrhagic and edematous pia with its many vessels could be seen.

*Theisen.*



**A Case of Meniere's Disease Dependent on Inflammation of a Nasal Sinus.**

PROF. H. BURGER (*Tydschr. v. Gen.*, February 8, 1908) mentions Ten Siethoff's description in 1898 of a series of cases of Menière's disease, where treatment of different nasal conditions removed the symptoms of this disease. At the Congress of Natural Sciences and Medicine in Leiden (1907), Ten Siethoff in an extensive report gave his endonasal treatment. He considers the large majority of Menière's diseases as reflex neuroses, originating in the diseased nasal mucous membrane. The attacks he explains as due to abnormal contacts in the nose. Burger does not think that this can be accepted generally. He found in a number of cases, on careful examination, a normal nose. Moreover a well-defined physiologic reflex as base for the reflex neurosis is absent in Ten Siethoff's theory. As he did not describe his cases extensively, nor give the results of the functional examination, the critic must for the present suspend judgment. But the inexplicability of these cases gives no right for ignoring them. Others have seen similar recoveries. Burger observed the following case in the spring of 1906: A 31-year-old woman suffered for a year with dizzy spells combined with nausea, noise in the left ear and a subjective sensation of turning around her body axis. These spells were very frequent, with danger of falling if she did not hold fast. Her head is kept fixed, as every turn to the left produced dizziness. Six years ago, after a delivery, she suddenly became deaf in the left ear, beginning with pain and dizziness. A year ago both drums were opaque, without reflex, not retracted. Watch: right at 55 cm., left 0. Whisper voice: right extent of room, left 30 cm. Rinne: right +, left —. Schwabach: right and left somewhat shortened. Weber: lateralization toward left. Upper limit Galton: right 0, 4; left 2, 5 (normal 0, 2). Lower limit: right 14 vibrations, left 100. Tuning fork (Quix)  $g^4$ ; right 15 sec. (= norm.), left 9 sec. With the goniometer a considerable diminution of the static equilibrium: inclination ant.  $8^\circ$ , post.  $6^\circ$ , lat. dext.  $9^\circ$ , lat. sin.  $9^\circ$ . She totters with eyes closed.

Diagnosis: Affection of the left middle ear and labyrinth. Superficial examination shows the nose normal; however, the anterior part of the middle concha shows polypoid enlargement, after lifting of which a pus line is seen in the middle



nasal canal. With an electric mouthlamp the right cheek and pupil are distinctly illuminated, while at the left all remains dark and patient has a subjective light sensation in the right eye alone. Patient has not a single nasal complaint; she remembers, after questioning, that for years she draws much secretion from the nose into the nasopharynx. And she has for some indefinite time a disagreeable smelling sensation on the left side. With roentgenoscopy in frontal direction and in three-fourths profile no difference between right and left, but positive difference a week later, at the expense of the left maxilla. She has suffered much with toothache, and her teeth are in deplorable condition. Under local anesthesia the antrum was opened in the fossa canina; it was filled with thick pus, and the mucous membrane was much swollen. The wall between antrum and nose was removed for a large part, and the mucous wound in the mouth sutured. All diseased roots were extracted. Two days after removal of the iodoform gauze from the nose she felt much better; headache gone, also the dizziness and noise in the ear. When patient went home the discharge had greatly lessened, and the kakosmia disappeared. The recovery was complete except for deafness on the left. No more dizziness and she can move her head freely in all directions. The secretion from throat and nose had entirely stopped. The last functional examination was about four months after operation: Watch: right 90 cm., left +0. Whisper voice: Right extent of room, left 12cm. Rinne: right +, left —. Schwabach: Right somewhat shortened, left not shortened. Weber: lateralization toward left. Goniometer: inclinatio lateralis, right 20°, left 22°; inclin. post. 21°. She walks well with eyes closed.

Burger wishes to drop the name Menière's disease entirely, or to use it for all cases where dizziness is present in spells with the character of aural vertigo, combined with nausea or vomiting, noises in the ear and diminution of aural acuity, the last of which remain in the intermissions. Aural vertigo is characterized by subjective sensations of turning and the appearance of head movement, especially on motion in one distinct direction.

Burger excludes the possibility that suggestion may have helped in the recovery, as no mention was made of a possible connection between nasal suppuration and dizziness. If a reflex-influence must be accepted, Burger considers vaso-

motor influences dependent on the pus formation. Francois Franck says that irritation of the sensitive nerves of the nasal mucous membrane produces dilatation of the vessels in all organs of the head. Blaauw.

## II.—NOSE.

### The Traumatic Etiology of Abscess of the Septum.

ANDEREYA, Hamburg (*Deutsch. med. Wochenschrift*, No. 4, 1910) reviews literature and concludes from study of his four cases that abscesses of the nasal septum are usually traumatic in origin, even though no history of the trauma can be elicited. He advises trial of replacement of fragments, but if this is impossible then a submucous resection is indicated. Horn.

### Some Complications and Dangers of Nasal Surgery.

TAWSE (*Lancet*, November 27, 1909). According to this writer, the frontal sinus operation as now carried out is the bugbear of modern rhinologic surgery and should only be approached with fear and trembling. He is satisfied when the patient is in the following condition: "In cases where pus escapes freely from the frontal sinus, and is producing no ill effects on the general health and only occasional headaches are complained of, I think the risk of the operation more than counterbalance its advantages. In considering the possibility of an operation, one must consider if the patient's confidence will stand the strain of perhaps a tedious and painful course of treatment, and one must be ready to banish all gloomy thoughts, to combat every evidence of flagging courage, and to make the patient feel that both are successfully striving to produce an early and favorable termination of the trouble. \* \* \* \* Women suffer from painful and irregular menstruation and discover some tender spot in the ovarian region and hurry to the gynecologist." These are certainly objections to the operation and the after-treatment, and make one wonder if it were not better that we call in a Christian Scientist in all of our Killian operations as an aid to the after-treatment. Horn.

### The Correction of Depressed and Irregular Deformities of the Nose by Mechanical Replacement.

WILLIAM WESLEY CARTER, New York (*Journal A. M. A.*, December 4, 1909). Dr. Carter has devised an apparatus for

the purpose of bringing into proper position the separate parts of a depressed nasal arch and holding them until union has occurred. This appliance, called a combined bridge and intra-nasal splint, exerts its force in accordance with the mechanical principles involved in the formation of the bridge of the nose—i. e., the arch.

It is applicable to three classes of nasal deformities, viz.: congenital, those due to disease, and traumatic. The extent to which the first two classes may be benefited depends upon the amount of healthy bony framework available for reconstructive purposes. Under traumatic deformities recent fractures present the ideal conditions for the use of the combined bridge and splint. In old traumatic deformities it is necessary to mobilize thoroughly all the tissues, and if there has been a loss of tissue it may be necessary to utilize a portion of the nasal processes of the superior maxillæ before applying the splint.

Dr. Carter reports a number of cases treated by his method and shows cuts of the splint illustrating its mechanical principle and method of applying. *Ryder.*

**The Submucous Resection of the Nasal Septum—A Raspatory for the Avoidance of Perforations.**

OTTO T. FREER, Chicago (*Journal of A. M. A.*, December 4, 1909). Dr. Freer finds that in the course of submucous resections perforations most often occur in baring the so-called ridge of its periosteal covering. The term "ridge" is used to describe the bony base of the septal skeleton and is composed of the incisor crest, the anterior end of the vomer and the superior maxillary crest. The periosteal covering of the ridge is distinct from the perichondrial envelope of the septum. The perforation is made along the top of this ridge, where the perichondrium and periosteum on one side are continuous with these membranes on the other side of the septum. The operator, after removing the cartilaginous deflection, tears or cuts his way into the other nostril in attempting to elevate the periosteum. The mucous membrane seems to tear very readily in this region, and a mere slit at first becomes a large hole when the ridge is resected.

Dr. Freer has devised a raspatory for the denudation of this ridge, which in his hands has proved successful. A cut is shown of the instrument and the technic of its use is described. *Ryder.*



### The Early Forms of Ozena.

E. BAUMGARTEN (*Archiv. für Laryngologie und Rhinologie*, Bd. 23, Heft 3, 1909) has found beginning ozena in children between 4½ and 5 years old. A stage of hypertrophy of the mucous membrane preceding the atrophic process has been frequently described, but, according to the author's investigations, this is not a true hypertrophy, but merely an intumescence of the inferior turbinate. This swelling gradually disappears until finally the picture of a genuine ozena is present.

The condition the author usually found in beginning ozena was an atrophy of the inferior turbinate of one side, with dried secretion of a grayish-brown color in the posterior part of the inferior meatus. In this stage the first symptom is apt to be a bad odor from the nose. In the other nostril there is usually a swelling of the inferior turbinate, which seems to be greater in young children. This one-sided contraction of the inferior turbinate the author regards as characteristic of a beginning ozena, and this is frequently followed in a few days by a fullness of the turbinate. After from 2 to 4 years both turbinates are contracted and then, as a rule, the crust formation and characteristic odor develop. The posterior part of the inferior meatus particularly becomes very wide, and the crusts and thick secretion appear first in this part of the nose. Ozena may develop shortly after the birth of the child, and children with eczema of the nasal vestibule should receive particular attention in this respect.

The author believes that if children do not develop ozena by the tenth year they will not get it at all. It rarely develops after the tenth year.

Girls develop ozena much more often than boys, and the writer is of the opinion that it is transmitted by the mother. He has records of a number of cases in which mothers with ozena had two or three daughters with the same disease, while the boys in the family were healthy. Lues does not play an important role in ozena. A good many cases of lues tarda in older children have been observed during a period of years, and ozena did not develop in any case. He has not observed that ozena develops more frequently in the children of syphilitic parents than in the children of healthy parents.

Not much weight should be attached to any of the many theories as to the origin of ozena. The author believes that



the most rational theory to explain the development of ozena is that a trophic disturbance of probably central origin results in a secretory anomaly in the nose, which in turn causes a lessening and drying of the secretion with crust formation. This producing pressure against the mucous membrane, causes circulatory disturbances, which result in the atrophy of certain parts of the nose.

*Theisen.*

### III.—PHARYNX.

#### **Gangrene of a Foot and a Lower Leg in a Child Consecutive to an Angina.**

H. A. LAAN (*Tydschr. v. Gen.*, January 25, 1908) reports the following case: A 7-year-old boy was healthy until March, 1905. He then complained of a sore throat, swallowing with difficulty, and had painful glands in the neck. Cod liver oil was given, and a Priessnitz bandage around the neck. The local symptoms had disappeared 14 days later, but edema of the face, hands and legs existed. The following day the legs were blue and ice-cold, while the swelling of face and hands disappeared after a few days. The physician then was called in. He found only some redness of the throat. At the same time an abscess in the gluteal region existed, which required much time for healing. About the middle of May demarcation at the legs was present. This process was left to nature and was finished in September, 1906. Oppression and heart palpitation accompanied the beginning gangrene, while the urine at that time was very dark, nearly black. Only in the beginning of January, 1907, could the parents be persuaded to do something for the child. It was then that Laan saw him. Laan performed some plastic operations, and with the help of some apparatus made him walk again.

Only four cases more are found in the literature of gangrene of the limbs in young persons consecutive to throat infections.

*Blaauw.*

#### **Diphtheria Following Tonsillotomy.**

LEVINSTEIN (*Archiv. für Laryngologie und Rhinologie*, Bd. 22, Heft 2, 1909) reports the following case: A child aged 7 years was brought to Prof. Fränkel's nose and throat clinic for an operation for tonsils and adenoids. On examination this condition was found and an operation advised. With the ex-

ception of the large tonsils, which were not inflamed, and the adenoid growth, nothing abnormal was found in the nose and throat.

The mucous membrane was normal in appearance. The operation was performed and the child was sent home, with the request that the parents bring her to the clinic again in a week. When the child was brought back the parents reported that she had not been well, had had fever right along, and had been breathing with difficulty.

On examination of the throat, both tonsil wounds were covered with a thick yellowish-white membrane. The dyspnea, croupy cough, and difficult breathing showed that the larynx was also involved.

The child was sent to the contagious ward of the Charité and was at first intubated, but as the tube was repeatedly coughed out, a tracheotomy was performed. Large doses of antitoxin were administered. A bacteriologic diagnosis of diphtheria was made.

Caille has reported two similar cases of diphtheria following the removal of tonsils. In Caille's cases the throats were also perfectly normal in appearance before operation.

The writer believes that these three children either had Klebs-Loeffler bacilli in their throats before operation, or some person who had charge of them was the carrier of the infection. The presence of virulent diphtheria bacilli in the mouths of healthy persons has frequently been demonstrated. H. W. Gross, out of 314 persons examined by him, found the bacilli in the throat or nose in 79 per cent.

Aaser found during an epidemic of diphtheria in a military barracks that 19 per cent of apparently healthy soldiers had virulent bacilli in their throats. Only a small percentage of them finally came down with diphtheria.

Geirsvold examined 967 healthy school children in a Christiania school shortly after a diphtheria epidemic, and found diphtheria bacilli in the throats of 9.2 per cent.

Statistics show that the bacilli are frequently found in the throats of healthy persons who had either had diphtheria some time before or had come in contact with it, and they may remain virulent for months. Such persons are the most dangerous carriers of the infection.

According to the literature of the subject, from 8 to 10 per

cent of persons coming in contact with diphtheria cases are carriers of virulent diphtheria bacilli, so that taking cultures from children's throats before every tonsil and adenoid operation might save them from autoinfection, but not from the danger of infection of the wound through persons looking after them.

*Theisen.*

**A Surgical Method for the Control of Hemorrhage After the Removal of Tonsils.**

COHEN (*Archiv. für Laryngologie und Rhinologie*, Bd. 22, Heft 3, 1909). Welty, Stucky, Richards and others claim that the loss of blood is less when the radical tonsil operation, that is, when the tonsils are dissected out, is performed, than when the tonsillotome is used, while Jackson, Thomas and Vaughan believe that it is greater.

It is worthy of note that in 34 of 54 cases of severe hemorrhage during the removal of tonsils collected by Smith and Wright, the tonsillotome was employed.

In three of six fatal cases of hemorrhage recorded in the literature between the years 1868 and 1904, the tonsillotome was employed. In the three other cases the method of operating was not stated.

In four other fatal cases of hemorrhage occurring recently the tonsillotome was also used.

In the author's experience the hemorrhage is greater with resection of the tonsils than when they are simply amputated, because in dissecting out the tonsils the vessels in the vicinity of the large arteries are cut.

Two cases of severe hemorrhage are reported. In the first, a young woman, aged 23 years, the tonsils which were very large, were removed in the writer's office with knife and forceps under local anesthesia. The hemorrhage during the operation was severe, and on one side was controlled with Monsell's solution. The patient was sent to a hospital with a hemostat in place on the other side. This was removed the same night, and the tampon three days afterwards, without any more bleeding. A secondary hemorrhage occurred on the right side on the ninth day, which was controlled with ice. On the next day another hemorrhage necessitated the application of the hemostat. When this was removed later on the same day a severe hemorrhage occurred, and it had to be applied again.



On the next day, twelve days after the operation, another severe hemorrhage occurred, and patient was in an extremely serious condition. She was then placed on the operating table, and a gauze tampon corresponding in size to the tonsil that had been removed, was pressed into the tonsillar fossa and held in place. A continuous suture was then carried through the faucial pillars. This was removed in four days, and the tampon on the fifth day. There was no further bleeding after this.

In the second case the tonsils were removed under local anesthesia from a man 36 years old.

The tonsils were dissected out with the capsules. No primary bleeding occurred, but on the evening of the same day, after coughing, a violent hemorrhage came on. The bleeding came from both tonsillar fossæ, but more from the right, and a spurting vessel could be seen deep in the right fossa near the base of the anterior pillar. A ligature was applied, and two other bleeding vessels were also ligatured, after which the bleeding stopped and did not return.

In considering the question of hemorrhage after tonsil operations, the author quotes the cases, 150 in number, collected by Damianos and Hermann. Of these, only five occurred in hemophiliacs. Of the eight fatal cases, it could only be determined that two were bleeders.

The wounding of the pillars is given as a frequent cause for hemorrhage, and many operators believe it is the usual cause with the newer method of operating. There is always more hemorrhage when muscle fibers are exposed. *Theisen.*

#### IV.—LARYNX.

##### The Value of Bronchoscopy in Internal Medicine.

EPHRIAM (*Berlin. klin. Wochenschrift*, No. 43-44, 1909). In a long and very interesting article Ephriam reviews in full the uses to which bronchoscopy has been put in internal medicine. The differences in the color of the bronchial mucous membrane, which until very recently we knew nothing about, has largely entered into the differential diagnosis of certain inflammatory conditions of the lungs. The diagnosis of various forms of stenosis of the bronchi have been made possible, and the local treatment has been carried out in a number of cases. Syphilis of the upper air passages has until only re-



cently been very little studied, from the clinical standpoint. We are now able to diagnose syphilitic stenoses and carry out a rational treatment. Much has also been learned about the presence of bronchial glands, and many obscure points cleared up.

In severe attacks of hemoptysis we may be able to clear up a diagnosis, and it has even been suggested that in severe cases we may tampon off one side of the lung or at least keep the other side from filling up with blood. *Horn.*

#### **Stenosis of the Larynx Cured by Intubation.**

EMIL MAYER, New York (*Medical Record*, December 25, 1909), reports three cases of laryngeal stenosis successfully treated by intubation following a gradual dilatation with the Schrötter tubes. The cases were all extreme, requiring tracheotomy, and were of unusual origin; one following a gunshot wound, the second a posttyphoid perichondritis, and the third a recurrent granuloma. One case, the gunshot wound, refused treatment after a certain amount of improvement. Case number two, the posttyphoid perichondritis, wore an intubation tube for five months, and at the present time (five years after removal of the tube) has only a slight hoarseness and no difficulty whatever in breathing. In the third case the intubation tube was kept in position for four weeks. One and one-half years have now elapsed since removal of tube, and there has been no return of any dyspnea. *Ryder.*

#### **Amputation of the Epiglottis in Laryngeal Tuberculosis.**

WOLFF FREUDENTHAL, New York (*International Journal of Surgery*, November, 1909), gives three indications for total removal of the epiglottis; first, dyspnea, caused solely by excessive growth of the epiglottis; second, a rapidly breaking down epiglottis, and third, dysphagia, which cannot be overcome by medical treatment. Laryngeal dyspnea due to an enlarged epiglottis occurs very rarely. The epiglottic lesion is usually coincident with other obstruction farther down—perichondritis of the arytenoids, infiltration of the vocal cords, etc. In such cases the only relief is tracheotomy.

In the second class of cases wide experience and good judgment only can tell what is best to be done. After extirpation

the process may rapidly spread, or again, local treatment may be sufficient.

The third indication is the most frequent. Here it is necessary to differentiate between ulcers on the top of a generally flattened epiglottis—that is, on its lingual side—and such ulcers as are hidden from view and cannot be reached by local treatment. Pronounced dysphagia with no visible ulcers is the diagnostic point. Such a condition cannot be treated locally.

Dr. Freudenthal has operated on fifty cases.

Ryder.

#### **Clinical Contributions to Esophagoscopy and Tracheobronchoscopy.**

OTTO KAHLER (*Wiener med. Wochenschrift*, Nos. 47, 48, 49, 1909). The technic of examination with the esophagoscope in cases of diverticulum is often made very difficult by the accumulation of enormous masses of food, and in many cases it is not possible to get a clear view during the first examination.

The patient should always be in the recumbent position, because in any other position the field of vision can not be properly cleaned.

Cases of diverticulum of the esophagus can be so readily diagnosed by an X-ray examination that the use of the esophagoscope may be dispensed with in such cases. The diagnosis can, however, be also easily made by means of esophagoscopy.

It is easy to get into the sac, but difficult to find the outlet of the diverticulum.

Cases of Zenker's diverticulum were most frequently examined.

Killian has described their positions very accurately, and he has been able in all his cases to see the esophagus as well as the sac. He found that they were located over the mouth of the esophagus, so that they must be regarded as pharynx diverticuli. This location explains the mechanical theory of such dilatations; esophagus spasm must be regarded as the cause.

The value of esophagoscopy in differential diagnosis was shown in two cases referred to the writer, with a probable diagnosis of carcinoma, and in which he was able to determine the presence of inflammatory ulcers.

Miss H. O., aged 19 years, was seen in April, 1909. Difficulty in swallowing for two months, with pain and retention of food. During the second examination with the esophago-

scope, made under cocain, two small ulcers could be seen about 20 cm. from the teeth. After eight days' treatment the esophagus appeared perfectly normal, so that the ulceration must be regarded as simply of a catarrhal nature.

The second case, that of a man aged 45 years, was similar, and was cured in a short time with silver nitrate and proper diet.

Catarrhal ulcers of the esophagus are uncommon, but have also been described by Gottstein and Rosenheim. The symptoms in the beginning are hard to differentiate from carcinoma, and the diagnosis can only be cleared up with the help of the esophagoscope.

The author also describes one case of syphilis of the esophagus and speaks of the importance of an early diagnosis in order to prevent the cicatricial stenosis which would surely follow a failure in making a correct diagnosis.

Primary esophagus spasm is of common occurrence and usually takes the form of a cardiospasm. Mikulicz was the first to describe the characteristic picture of this condition.

Spastic stenoses without some anatomic basis are rare in the upper parts of the esophagus. The picture of a cardiospasm as well as that of a spasm of the esophageal entrance is hardly different from that of a normal closure. In all cases of cardiospasm a distinct widening of the esophagus could be seen.

Four cases of idiopathic dilatation of the esophagus are reported in the author's article.

One case (from the same clinic) was reported by Glas, which pointed to the probable truth of Kraus' theory. In this case, in which a dilatation of the esophagus was present, a compression of the vagus by a mediastinal tumor could be determined.

In considering tracheobronchoscopy the author states that direct laryngoscopy should not replace the indirect method of making laryngeal examinations.

The ordinary laryngeal operations, such as the removal of polypi, papillomata, curettage of tuberculous infiltrations, etc., can be performed in the old way with much greater comfort to the patient.

Direct laryngoscopy is of great value in children, and five cases in which papillomata were removed in this way in children, under general anesthesia, are reported.



Direct tracheobronchoscopy gas proved of the greatest value in the removal of aspirated foreign bodies from the trachea and bronchi.

Killian in 1897 was the first to remove a foreign body from the air passages in this way, and since that time a large number of cases have been reported by Jackson, Neumayer, Schrotter, Schneider and others. V. Ecken has collected over 400 cases from the literature.

In the author's clinic sixteen foreign bodies were removed from the trachea and bronchi, the youngest patient being a child of 6½ months.

He has been able to collect seven cases of bronchoscopy for foreign bodies in children under one year.

In six of the author's cases the foreign body lodged in the trachea, in nine in the right bronchus and in one in the left.

Foreign bodies are aspirated into the right bronchus much more frequently than into the left. Of 125 cases collected by Gottstein, 77 were in the right and 25 in the left bronchus.

*Theisen.*

#### V.—MISCELLANEOUS.

##### **The Value of the Wasserman Reaction in Rhinolaryngology.**

WEINSTIEN, New York (*Deutsch. med. Wochenschrift*, No. 39, 1909), finds this reaction of great value in doubtful cases. A positive reaction is certain proof of the presence of syphilis, while a negative reaction gives a 90 per cent possibility that the disease is absent.

*Horn.*

##### **My Experience With Fifty-three Operations for Cleft Palate.**

HELBING, Berlin (*Berlin. klin. Wochenschrift*, No. 39, 1909), has had a great experience in cleft palate operation. The reviewer was present when he read the above paper, which was received with a good deal of respect. An assistant of Brophy, of Chicago, quietly arose in the discussion and reported nearly 2000 cases. It was quite a surprise to the Germans present. Helbing takes the standpoint that the modern operation for cleft palate is an invariable substitute for all prosthetic appliances, and that cases as young as four months can be operated without danger. He has never lost a patient. He describes a few modifications in the technic of the operation.

*Horn.*



**Anomalies of the Mucous Membrane of the Mouth in the Young-Born as a Sign of Degeneration.**

CORNELIA DE LANGE (*Tydschr. v. Gen.*, November 16, 1907) observed some years ago the gingiva in a four-weeks-old child covered with numerous small irregularities, knobs and small lumps, anteriorly and posteriorly, as well as at the free margins. The mucous membrane had the same color at the point of the irregularity as at the smooth parts. Later it was found that the child suffered from myotonia congenita (Oppenheim); the child had hernia umbilicalis and hernia scrotalis. There was no lues present. After appearance of the first dentition the abnormality of the gingiva was less distinct. After seeing this case she found oftener the condition in the newly born, constantly with other degenerative signs. They had all an abnormally strongly arched palate; in many the auricular concha was abnormal. One had a small auricular fistula on the helix, another a small fibroma directly before the tragus, etc.

In a patient with pedes vari congeniti and other defects, most probably due to amniotic strings, the gingiva showed two small elevations at the place where later the lower inner incisivi come. An ogival palate was also present.

She noticed twice at both sides, where later the milk molars appear, a symmetrical protrusion of the mucous membrane of the jaw, in the first case 1 cm. long,  $\frac{1}{2}$  cm. high and thick; in the second case somewhat smaller. In both children this excrescence was only just indicated on the upper jaw; the first child has a gothic palate and an asymmetric skull and face, the second had an abnormally arched palate and an umbilical hernia.

*Blaauwe.*

**Further Observations on Bismuth and Other Paste Treatments in Suppurative Diseases of the Nose and Ear.**

JOSEPH C. BECK (*Ohio State Medical Journal*, September, 1909) states that he has been guided in using the bismuth paste in the treatment of suppurative diseases of the nose, ear and throat by the results that the general surgeons have obtained in suppurative diseases of other cavities of the body, as suppurative diseases of the joints, etc. The author has also used the bismuth paste as a dressing after the acute mastoid operation with drainage. He states that the reason the same success that the general surgeons have had has not been obtained with this method of treatment is because the accessory

nasal cavities are noncollapsible cavities, lined with mucous membrane.

The following four formulæ have been employed: Paste 1.—Bismuth subnitrate 33, vaseline 67. Paste 2.—Bismuth subnitrate 30, vaseline 60, white wax 5, paraffin (melting at  $120^{\circ}$ ) 5. Paste 3.—Bismuth subnitrate 30, vaseline 50, paraffin 10, white wax 10. Paste 4.—Bismuth subnitrate 30, vaseline 35, paraffin 25, white wax 10.

Formula No. 1 is practically the only one used in suppurative conditions of the ear and accessory nasal cavities. No. 2 is used as a mastoid dressing after the radical operation, and Nos. 3 and 4 are used in place of the Moorhoff plug.

Slides were shown showing the anteroposterior and lateral radiograms of injected antra of Highmore, frontal sinuses, sphenoidal sinuses, the ethmoidal region, external and middle ears and the mastoid process after operation. The slides showed positive proof of the cavities being injected.

Several slides were shown of injected chest cavities for the cure of empyemata. This was to demonstrate the absorption of the bismuth paste. One series of three showed where the patient received an injection of 600 grains of paste No. 1, and it became absorbed in a little over two months' time, with a cure of the empyema. These cases were out of the practice of Dr. Emil Beck, the author of the bismuth paste method of treatment.

Two slides were shown of microorganisms (tubercle bacilli) after the injected cavity was treated by bismuth paste for a short time. These were granular and showed evidence of destruction. Many experiments have been made on infected cavities with various microorganisms after these were injected with the paste, and it was found that the material withdrawn gave negative results on culture media.

It is therefore concluded that when the paste comes in contact with an infected surface of a cavity or channel it there causes a leucocytosis, which, in turn, destroys the microorganisms by a chemotactic action. Another very interesting observation that was made in connection with the bismuth paste treatment is the adjunct application of vaccine therapy. It has been found in a few cases that did not do well by the use of the paste that they improved more rapidly when the auto-vaccines were employed in conjunction with the paste.

*Theisen.*

**A Brief History of the Treatment of Stammering, With Some Suggestions as to Modern Methods.**

G. HUDSON-MAKUEN, Philadelphia (*Medical Record*, December 18, 1909). With a little external help, one-fourth of the stammerers might overcome the defect. The cure of the remaining three-fourths presents a very different problem.

The stammerer's speech is faulty in every particular. The central mechanism is out of gear, and his mental attitude towards speech is wholly wrong. The problem is a complicated one, involving not only the mechanism of speech, but also some of the highest intellectual and emotional centers of the brain.

Its scientific treatment must have for its purpose the thorough re-education of the individual. It must supplant his abnormal speech with normal, make it easier for him to speak fluently than to speak hesitatingly, and must develop the patient's confidence in himself. It should be a development of correct speech rather than a cure of the stammering.

The stammerer's instrument, of course, must be put in good condition by the removal of all obstructions, and then he must be taught to use this instrument. Exercises, educational and physiologic, must continue long enough to allow the patient to form entirely new habits of speech and must be adapted to the requirements of each case.

Ryder.

**Case Illustrating a New Operation for the Closure of the Mastoid Wound by a Muscle Flap.**

SAMUEL IGLAUER (*The Lancet-Clinic*, April, 1910). E. G., female, aged two years, first seen February 28, 1910, suffering with earache.

Previous history: The child had always been well, except for a diarrhea last summer. The present trouble had begun three or four days before with pain in the left ear, without discharge, and with slight fever.

Examination: Well developed and well nourished child. The right ear appeared normal. The left ear showed a reddened bulging drum without a perforation. There was no sinking of the meatal wall. The mastoid seemed to be somewhat tender. An incision of the drum was made and was followed by a discharge from the ear.

March 2. Radiograms by Dr. S. Lange showed a diffuse



clouding of the mastoid region on the left, with a normal mastoid on the right.

March 4. The child suffered with earache and sleeplessness at night. There was a rather free discharge of pus. The meatus appeared normal.

Operation, March 7, 1910: Simple mastoid operation. The bone was found to be soft and necrotic and very vascular. Granulations in the antrum. Dura exposed in the middle fossa.

Plastic operation: The original incision was prolonged upward and then forward into the scalp, which was then dissected free from the posterior portion of the underlying temporal muscle. The exposed muscle tissue with its overlying fascia was then freed from the cranium and split parallel to the muscle fibers, thus forming a muscle flap, with its base under the zygomatic arch. This flap was then rotated downward and backward and was implanted into the mastoid wound, where it was held in place by catgut sutures fastened to the periosteum at the posterior margin of the wound. A drainage tube was introduced into the antrum and gauze was packed around the tube. A counter opening was made through the scalp over the defect corresponding to the original site of the muscle flap and a small drainage tube was introduced here. The original incisions were closed with silkworm gut, except in the region about the drainage tube.

After-treatment: The subsequent course was uneventful, except for a slight edema of the left eyelid and for a hematoma, which formed under the scalp and which suppurred to some extent on the third and again on the thirteenth day. The drainage tube was removed from the mastoid on the third day and the discharge from the meatus ceased by the seventh day. The skin incisions closed by primary union. The discharge from the mastoid wound ceased by the eighteenth day, and the child left the hospital on the twentieth day.



## BOOK REVIEWS.

### **The Functional Test for Hearing. (Ueber die funktionelle Prüfung des menschlichen Gehörorgans.)**

BY PROF. FRIEDRICH BEZOLD. Edited by PROF. DENKER. Published by J. F. Bergmann, Wiesbaden. Unbound, 6 Marks.

Prof. Denker, of Erlangen, pays his respects to the memory of Prof. Bezold, in editing this third volume of his teacher's monographs. Under stress of pain and suffering, the great master of the Munich school strove to complete this series of articles, which should be his last message to his former pupils. The volume contains five monographs. The first, second and sixth reiterates his former views on the transference of sound waves to the internal ear by means of the ossicular chain alone and not by means of bone skull conduction. The third is a study of a case of congenital atresia of the external ear. The last describes his model of the ear, on which he spent so much study. The thanks of the profession is due Prof. Denker for this labor of love, and we hope the book will have a wide circulation amongst Prof. Bezold's former pupils. *Horn.*

### **Abscess of the Brain. (Der Hirnabszess.)**

BY OPPENHEIM AND CASSIRER. Alfred Holder, Leipzig, Publisher. Second Edition, 1909.

The second edition of Oppenheim's Brain Abscess is without question the most important monograph on this subject that at present exists. The statistics of the American, English and German schools have been carefully analyzed, and we are able to gain a clearer insight into the etiology of the abscess than ever before. Over 40 per cent of the abscesses are of otitic origin, and the otologists more than any other class of practitioners should have the subject thoroughly in the hand.

The chapter on Symptomology is exceedingly important, and nowhere do we have the subject matter so clearly and concisely stated as in this book. The remarks on the presence of temperature are of the greatest value. Summing the question up, he concludes: \* \* \* "The temperature during the entire observation period may remain normal. \* \* \* Often

it sinks beneath the normal line as low as 35.5° C. \* \* \* In the preliminary stage we may often have a slight degree of fever. If the trouble starts in acutely, we will always find fever. Because we so often miss this beginning stage, many observers have come to the conclusion that the usual course of the brain abscess is without fever." Since the first edition of this book the percentage of pathologic changes found in the fundus have greatly increased, from 35% to 55%, due to our more careful methods of observation. It is impossible to mention every symptom in this review that has come to be regarded as of value, but any otologist who would attempt to make a diagnosis in a complicated case of brain abscess without being familiar with the contents of this important chapter would be guilty of carelessness.

The Chapter on Diagnosis covers many fields that the otologist should be more familiar with. It is not always necessary to call in an internist to tell us what might be the trouble, if we have first thoroughly digested the subject matter of this carefully summarized part of the book.

Oppenheim's own statistics, which give his cases up to 1901, show that in 206 operations for temporal lobe abscesses, 148 were cured, or over 70 per cent. Of the cerebellar abscesses 45 per cent were saved. Certainly a brilliant record for the German school.

*Horn.*

**Direct Laryngoscopy, Bronchoscopy and Esophagoscopy. (Die direkte Laryngoskopie, Bronchoskopie und Oesophagoskopie.)**

By W. BRUENINGS, Freiburg. Published by J. F. Bergmann, Wiesbaden. Price, bound, 14 Marks. 122 Illustrations in Text. 400 Pages.

Perhaps no book dealing with a medical subject has been in recent years so eagerly awaited as this of Brünings, the well-known assistant of Prof. Killian in Freiburg. It hardly seems possible in the very few years since Prof. Killian first examined the bronchi by means of a rigid steel tube, that the importance of the subject should so grow, and the technic and instrumentarium should be so enlarged as to demand a text-book of nearly 400 pages. And yet every word of this book is important, there is no padding, no large type and wide margins, but it is all solid reading, and very important reading as well.

Prof. Killian has had students from all parts of the world, but the American students are amongst his most ardent admirers. It will be a great pleasure to know that they can now possess themselves of the latest word on the subject of bronchoscopy, just as Killian believes in it, and just as it is given in Brünings' courses in that famous old German town. Brünings has given the same charm to his book that he gives to his lectures. One does not need to cross the ocean to understand the subject. The thing which characterizes this book is a wealth of detailed information put with such clearness that one feels a sense of security when one is attempting one's first bronchoscopy.

The photographs of the bronchial tree are magnificent. The details by which the bronchi were prepared for the X-ray photograph show a care in the securing of accurate results which have never before been attempted. The other illustrations are very helpful, and show at first glance just how the patient should be placed for the various methods of bronchoscopy and esophagoscopy.

The chapter which interests the American school the most is a comparison of the methods of illumination. Brünings has not only practically but theoretically proved that a source of light constructed according to his principle and situated at the upper end of the tube has overwhelming advantages over the method of Jackson, where the tiny lamp is carried to the distal end of the tube. The disadvantages of the latter method are the liability of the lamp burning out in the middle of the operation, the danger of breaking, the necessity of constant renewal during an operation to prevent a dimming of the light from blood, mucus, etc., and the greater loss of space in the inner diameter of the tube.

Of the advantage of the extension tube, which Brünings himself invented, there can be to-day no doubt. It is probably his most important contribution to the instrumentarium of bronchoscopy. It has been slightly improved in the last year, and in its present state seems to be as near perfect as one could wish. The remainder of the First Part of the book is a description of the instruments used in the various procedures.

The Second Part takes up the greater portion of the book and is divided into seven chapters.

Chapter I, headed "Endoscopic Propadeutic," gives advice



as to the selection of a complete instrumentarium, exact knowledge as to the kind and amount of the electric current to be used and a careful description of the methods of practicing on the lower animals, the phantom and the dead body.

Chapter II deals with the methods of anesthetizing. Some very important experiments were carried out to determine the amount of cocain which could be used with safety. The ordinary danger limit as usually stated is of no value. Much depends on the method of using, whether in spray or cotton; on the idiosyncrasy of the patient; and the time of day in relation to food ingestion. On an empty stomach, the patients stand cocain badly.

Chapter III deals with direct laryngoscopy, a subject which is receiving more and more attention in Europe. Brünings carries out many operations on the vocal cords by this direct method which formerly were only possible with the mirror.

The anatomy and physiology of the trachea and bronchi, as set forth in Chapter IV, make known for the first time a mass of new facts on these two subjects which will command the attention of all classes of medical men. This chapter shows more clearly than any other how very carefully the whole subject has been worked up, and how this whole new field of bronchoscopy is not based on empiricism, but on a solid anatomic and physiologic foundation.

Chapter V is, of course, the kernel of the whole book. It deals with the direct and indirect tracheobronchoscopy, as Brünings calls the procedure. A detailed review is impossible. I repeat, the subject is so clearly stated that it is almost as good as a personal course with this great teacher and puts everyone in a position where he ought to be able to carry out a successful bronchoscopy the first time he tries it.

The last chapter is devoted to esophagoscopy. The subject is considered in great detail, and will prove very helpful, even to an experienced man.

Take it all in all, the book fulfills more than the most ardent admirers of Killian and Brünings expected of it, and will prove a lasting monument to him, to his famous teacher, and to the clinic at Freiburg. The presswork of the book is above criticism, and the illustrations leave nothing to be desired.

*Horn.*



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XXXIII.

THE SUBPERIOSTEAL ABSCESS OF THE MASTOID  
REGION.

BY PROF. HOLGER MYGIND,

COPENHAGEN.

The subperiosteal abscess of the mastoid region is a fairly frequent disease. This is evident from the fact that during the last four years and a half, one hundred cases have been treated in the Ear Department of the Copenhagen Commune Hospital, out of about 2500 cases of acute and chronic middle ear suppuration which came under observation during the same period.

This disease may be a purely primary disease; in my 25 years' experience as an otologist I have, however, never observed such a case, and the above mentioned 100 cases were all secondary, the primary disease having been suppuration of the middle ear. The subperiosteal abscess is then an otogenic disease.

*Sex and Age.*—In the 100 cases here to be dealt with the sex and age were as follows:

	Males.	Females.	Total.
Under 1 year.....	12	3	15
From 1 to 4.....	12	20	32
From 5 to 14.....	15	23	38
From 15 to 19.....	4	4	8
From 20 to 24.....	0	0	0
From 25 to 44.....	5	2	7
Above 45 .....	0	0	0
	<hr/> 48	<hr/> 52	<hr/> 100

From the above table it will be seen that neither sex predominated decisively, while there is a marked difference in the distribution in the age classes. Eighty-five per cent were under 15 years of age and 15 per cent under 1 year of age. As individuals under 15 years of age only represent 34 per cent, and infants only 2.7 per cent of the whole Danish population, it is evident that subperiosteal abscess is most frequent in childhood and especially in infancy. The youngest patient treated was two months old, the oldest 43 years.

I may perhaps mention that in 48 cases the abscess was on the right side, in 52 on the left. Four of these cases were bilateral.

*Etiology and Pathogenesis.*—As there are various and practically important circumstances to be discussed under this heading, I purpose dealing with these two points in the nosology of the disease somewhat more exhaustively. There is particular reason to do so, as the literature contains but little which elucidates the etiology and pathogenesis of the subperiosteal abscess.

As to the nature of the primary ear disease: In the great majority of cases (78 per cent) the primary middle ear suppuration was of an acute nature. The primary acute middle ear suppuration was of specific nature in only a very few of the cases treated by me. Thus there were only four cases of measles, one of typhoid fever and two of scarlet fever; but there is no doubt that we should arrive at a very different result if we took our material from an infectious hospital, as it is beyond all question that the part played by scarlet fever

would be much greater. Tuberculous acute middle ear suppuration was doubtless the cause in three cases, as in that number of cases tubercle bacilli were found in the diseased bone, which was the transitory medium. In this connection I may mention that tubercle bacilli were found in the granulations in the mastoid process in one case out of 22 cases of chronic middle ear suppuration (with osteitis of the mastoid process).

The period during the acute middle ear suppuration at which the subperiosteal abscess appeared varied from two to three days to nine months (five cases) after the first appearance of the aural symptoms. By classifying the cases according to the duration of the primary aural trouble the following table is obtained:

Duration from 2 to 7 days.....	25 cases
Duration from 7 to 14 days.....	3 cases
Duration from 14 to 21 days.....	7 cases
Duration from 21 to 30 days.....	9 cases
Duration more than 1 month.....	25 cases
Duration unknown .....	9 cases
<hr/>	
Total .....	78 cases

This would seem to prove that subperiosteal abscess in the mastoid region is an otitic complication, which appears, as a rule, either in the course of the first week of the acute middle ear suppuration or very late—more than a month after the commencement of the aural disease. On further investigation it will be seen that in all the cases in which the complication appeared at an early stage the patients were children and the majority infants. On the other hand, the disease may also appear in young children in the course of the middle ear suppuration, but this is rare in children under one year old.

In order to discover what bacteria were of etiologic importance, I had, in the majority of cases, the pus from subperiosteal abscess examined bacteriologically at the Pathological Institution of the Copenhagen Commune Hospital. The reason it was not done in all cases was not that it was forgotten, but that the pus was present in very slight quantity or was difficult to collect on account of the considerable intermixture with blood from the incision. This intermixture with

blood was doubtless also the reason why the bacteriologic examination gave a negative result in eight cases. The following are the forms of bacteria which were found:

Streptococcus .....	21
Staphylococcus .....	8
Pneumococcus .....	4
Streptococcus and staphylococcus.....	4
Streptococcus and pneumococcus .....	1
Streptococcus and other bacteria.....	2
Staphylococcus and other bacteria.....	2
Pneumococcus and staphylococcus .....	2
Various other bacteria.....	7

The cases in which only one kind of bacteria was found were, with only one exception, cases of acute middle ear sup-puration.

The preponderance of streptococcus is conspicuous and is doubtless an indication that streptococcic angina is often the first stage in the course of the disease.

It is an obvious conclusion that retention of pus in the tympanum is an important etiologic factor. It is, of course, often difficult to prove the presence of this phenomenon. In several of my cases it was, however, possible to do so with certainty, viz., in cases where the otoscopic examination showed an absence of pus in the auditory passage and no perforation of the drumhead. This happened in 15 cases. Further, in several cases the tympanic membrane bulged out considerably and exhibited a small and very unfavorably situated perforation. In 7 cases this bulging out of the membrane took the form of a nipple, a condition most unfavorable to the flow of pus, partly because this form of bulging is almost always situated in the posterior superior part of the tympanic membrane, and partly because the perforation in such cases is always very small. Among other circumstances indicative of the retention of pus I may mention that in several of my cases the secretion in the tympanum was very slight and partially dried up; further in cases of acute suppuration of the middle ear there was a bad odor (23 cases); but we must, of course, remember that, when the patients are infants, acute suppuration of the middle ear is often accompanied by an unpleasant odor. Another phenomenon favorable to retention



was observed comparatively often, viz., swelling of the posterior wall (12 cases).

In cases of chronic suppuration causing mastoid subperiosteal abscess, the state of the tympanic membrane plays, of course, a less important part as an etiologic factor, as far as retention is concerned, the membrane in the great majority of cases being extensively destroyed. My investigations, however, show that a pathologic product is often present, which is certainly of moment in respect to retention, viz., cholesteatomatous masses. In 16 of my 22 cases of chronic suppuration the operation revealed a cholesteatomatous inflammation in the middle ear and in the mastoid process, which form of inflammation is, therefore, an important etiologic factor in the formation of abscess. Polypi I found only twice.

It is evident from the above that there is every reason to suppose that retention of pus in cases of acute suppuration of the middle ear is a prominent etiologic factor in subperiosteal abscess.

Among all my cases, however, there was not a single one of uncomplicated middle ear suppuration causing subperiosteal abscess in the mastoid region. In all the cases there was also an osteitis in the mastoid process, and there is no doubt that it is exceedingly rare not to find this phenomenon. The existence of an osteitis was proved in these cases by the resection of the mastoid process performed in all. The osteitis presented two prominent characteristics. The first was an acute inflammation of the bone, even in those cases where the primary disease was a chronic osteitis. The second, which was not observed in all, but in the majority of cases, was the presence of a diffuse process, rapidly causing considerable destruction of the mastoid process. To illustrate this latter condition, the case-books of the aural clinic of the Copenhagen Commune Hospital contain detailed descriptions of the macroscopic results of the operations and also schematic drawings showing the seat and area of the pathologic process. By the aid of these descriptions and drawings I have arranged the cases in three groups. The first embraces those cases where the osteitis included only the immediate surroundings of the mastoid antrum. The second includes the cases where the osteitis had spread over the greater part of the mastoid process, while the third embraces those cases where the whole mastoid

process was involved. These three groups represent, respectively, 10, 40 and 50 cases. In the great majority of cases it will be seen that the osseous process was very extensive. This is further evident from the fact that the dura mater was exposed in the majority of cases and the sigmoid sinus in no less than 59. Finally, the apex of the mastoid process was removed entirely in 20 cases.

Having dwelt upon the intensity and the extension of the osteitis causing subperiosteal mastoid abscess, I now mention certain circumstances which prove that comparatively frequently it is also of malignant character. This appears from the fact that it leads to endocranial complications with a frequency which is comparatively great in relation to the occurrence of these complications altogether. Thus, there were 13 cases of episinusitis, i. e., a formation of granulations on, and a thickening of the walls of, the sigmoid sinus. In 5 cases there was also a perisinus abscess. In 6 cases the operation revealed a phlebitis of the above mentioned sinus in connection with a formation of thrombus in the sinus. In 3 cases there was an epidural abscess, in 2 pachymeningitis externa, and in one case pachymeningitis interna. Cerebral abscess was found twice, and meningitis three times. As a consequence the subperiosteal abscess presents a high mortality, 9 per cent of my cases. This mortality rate corresponds exactly to that for all the mastoid operations performed in my hospital department, where, owing to the comparatively large number of intracranial operations, the mortality rate is high.

The question now to be asked is, How does the inflammation of the middle ear spread to the subperiosteal cavity and cause an abscess? According to most authors, the answer is very simple, the general opinion being that the pus from the cells in the mastoid process perforates the corticalis, thus reaching the subperiosteal cavity through the medium of the mastoid process. An investigation of my material, however, proves that this is the exception, not the rule, and that there are many ways by which the process spreads upwards to the surface.

It is a fact that a defect of the corticalis is present in the great majority of cases, as it was found in two-thirds of all the cases which I treated (67 cases), but somewhat more than one-fourth (27 cases) exhibited no change in the surface of

the corticalis, or only small, bleeding spots over the fovea mastoidea. In the remaining 6 cases there was no actual destruction of the bone tissue at the bottom of the fovea, but a slight softening of the bone.

It does not, however, follow, because the corticalis in the mastoid process in a large majority of cases displays no macroscopic changes, or is only slightly altered, that the disease has not reached the surface through the corticalis; for when no other path of communication between the primary disease of the middle ear and the periosteal process is discoverable it must be supposed that the inflammation is "metastatic" through the numerous blood vessels which the periosteum sends into the corticalis, especially in the mastoid fovea.

I will now briefly describe the various roads through which the primary inflammation spreads to the surface and causes subperiosteal abscess in the mastoid region, and also the pathologic changes revealed by operation.

What most frequently occurs is that an acute suppuration of the middle ear, after the duration of some time—sometimes only a few days, more frequently five or seven days, in a minority of cases after a longer period—causes an acute osteitis of the mastoid process, or that a chronic osteitis in the mastoid process becomes complicated with an acute inflammation. The osteitic process then spreads to the corticalis which, in an area varying from a quarter to half a square inch, becomes replaced by granulation tissue. This mass of granulations fills the corticalis like a stopper and is, in the majority of cases, situated in the mastoid fovea, on a level with the spina suprameatum and about a quarter of an inch behind it. It may also be found further down, but never much below the base of the tip of the mastoid process, as the sinewy fibers of the sternocleidomastoid muscle below this line merge with the periosteum and are intimately connected with the corticalis. I have, however, in several cases seen the process penetrate to the surface here and cause the formation of an abscess inside the fascia of the muscle, as also deeply seated muscular abscesses may be formed by penetration of the mastoid terminal cells. In a few cases the corticalis was perforated above the porus acusticus externus (3 cases), and the inflammation spread this way from the squamous antrum. In one case the patient was an adult. Frequently no pus at all, or very little,



is found in the above described granulation "stopper," or indeed in the osteitic process altogether, a regular pus-conducting fistula being but seldom met with. Sometimes two or three openings filled with granulations are found in the corticalis, and now and then it is full of holes like a sieve. Sometimes the destruction extends to the posterior superior wall of the osseous auditory canal and comprises a part of it. When the osteitic process penetrates to the surface and reaches the deep layers of the periosteum, a mastoid periostitis sets in, the periosteum becomes considerably thickened, afterwards soft and necrotic. As a rule, the inner surface of the periosteum is found covered with a layer of granulations. In a number of cases the process remains at this stage for some time, without forming any actual abscess. It may even spread further towards the surface without simultaneously forming pus in the subperiosteal cavity; in such cases the periosteum is generally destroyed in an area of from a quarter to half an inch. Through this opening a direct communication is established between the above mentioned stopper and a subcutaneous abscess cavity (32 cases)\*, which cavity often attains to great dimensions. A subcutaneous mastoid abscess need not, therefore, always correspond to a true subperiosteal abscess.

In the majority of cases, however, a subperiosteal abscess is formed, with pus varying in quantity from a few drops to one-quarter of a liter. This pus may be fetid, especially in chronic cases. In one case gas was also developed. As a rule, the pus is of character pus bonum, but it often varies in color, is gelatinous, thin, etc.

This is the typical way in which the subperiosteal abscess in the mastoid region is developed, the development being often extremely rapid, especially when the patients are young children. Thus, a few days after the commencement of a suppuration of the middle ear a mastoid abscess may appear, upon opening which one may find the whole mastoid process converted into soft tissue.

In a much smaller number of cases (11) the inflammation does not spread from the middle ear through the mastoid process, although complicated with an osteitis in the latter, but along the posterior superior osseous wall of the auditory

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\*In two cases the subcutaneous abscess was of purely glandular nature.



meatus. Here we find a "granulation string" between the osseous wall of the auditory meatus and that part of the skin which covers the meatus and which is completely merged into the periosteum, forming with it one fibrous membrane.

When the inflammation spreads in this manner, the otoscopic examination reveals a very considerable bulging forward of the deepest part of the upper and posterior portion of the wall of the auditory meatus, so that the background is hidden more or less entirely. A remarkable circumstance is now and then observed when the inflammation is propagated in this manner, viz., that no pus is found in the mastoid region when the usual incision is made; it is only when the periosteum is loosened from the neighborhood of the spina suprameatum, where it always adheres more firmly to the bone, that the pus streams out. This form of abscess may perhaps be termed *abscessus subperiostalis parameatum*' (3 cases).

A third way by which the inflammation in the middle ear may directly reach the subperiosteal cavity is through the *fissura mastoidea-squamosa* (3 patients, the eldest 14 years old). The pus oozes through the suture in which granulation tissue may be formed.

Finally, the pus may force its passage through an emissary vein (Körner), but I myself have never met with such a case.

This brings me to the end of my remarks on the etiology and the pathogenesis of the mastoid subperiosteal abscess, with which I have dealt somewhat more exhaustively on account of the new matter my investigations have brought to light. There remains to be mentioned in all briefness a few circumstances with regard to the subjective and objective symptoms and also treatment.

There is one subjective symptom which deserves particular notice, because it so often deceives both the patient and the medical attendant, if the latter has no experience with the disease in question. I refer to the absence of pain. It is very common for the patient to suffer pain, even severe pain, prior to the formation of the abscess in the mastoid region, which pain disappears as soon as the swelling behind the ear shows itself. Inexperienced observers, therefore, take this as a favorable symptom, imagining that the disease has culminated and hoping that the incision of the abscess will bring about recovery. Another favorable objective symptom perhaps en-

courages them in this delusive hope, viz., no temperature or a very slight rise. The following table illustrates this peculiarity:

Temperature (rectal)	99 ° or under	in 35 cases
Temperature (rectal)	99 °—100.5°	in 28 cases
Temperature (rectal)	100.5°—101.5°	in 22 cases
Temperature (rectal)	101.5°—102.5°	in 4 cases
Temperature (rectal)	.....over 102.5°	in 11 cases

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100 cases

A temperature of above 102.5° in cases of abscess in the mastoid region must always raise suspicions of intracranial complications (5 cases) and increase the gravity of the prognosis (4 deaths out of 11 cases where the temperature was above 102.5°).

I have nothing of special interest to say as to the objective local symptoms. They are, as is well known, swelling, which may be enormous (5 inches by 4 inches in one of the cases observed by me); redness, heat and tenderness of the skin of the mastoid region. I may perhaps mention that the sense of fluctuation obtained on palpation of the mastoid region when it is the seat of swelling is often delusive. Fluctuation was often distinctly felt, apparently, in cases of acute mastoiditis, where the operation revealed no accumulation of pus, the pseudofluctuations being caused by edematous swelling of the integument. On the other hand, smaller accumulations of pus under the periosteum often give no sense of fluctuation at all. Finally, I may mention that there is sometimes a communication between the pus beneath the periosteum and the pus in the auditory meatus, so that the pus may be forced out of the aural passage by pressing the swelling of the mastoid region (5 cases). The communication is brought about by the partial destruction of the cartilaginous part of the auditory meatus in conjunction with destruction of the lateral part of the porus acusticus externus, or by destruction of the cartilaginous parts of the aural passage where it adheres to porus acusticus externus.

Treatment may be dealt with briefly.

Many medical men, other than otologists, are of opinion that in order to cure the primary middle ear suppuration it is

sufficient to perform a simple incision (the so-called Wilde's incision), in cases of subperiosteal abscess in the mastoid region. I will not for a moment deny that this simple little operation may sometimes bring about the desired effect. But when one takes under consideration that in every one of the 100 cases on which this paper is based, there were osteitic changes in the mastoid process, that these changes were often intense and widespread, that they were comparatively often complicated with intracranial troubles, and finally, that the mortality rate was proportionately high, even when the patients came under treatment early, as was the case with the majority, then I must insist that Wilde's incision is absolutely inadequate, as the patient runs a very grave risk when a more radical operation is not resorted to. Several patients with serious intracranial complications came into the aural department of the Copenhagen Commune Hospital after Wilde's incision had been performed, and in all these cases the resection of the mastoid process and craniotomy came too late to save the patient. In my department, therefore, resection of the mastoid process is performed as soon as possible in cases of mastoid abscess, preferably the very day the patient is admitted. As a rule, in cases of chronic middle ear suppuration, radical resection of the middle ear should be performed, but when the patient is under 8 years of age the after-treatment is often extremely difficult on account of the child's resistance to change of dressing, and also because the parents are negligent in bringing the child for treatment. Therefore simple resection of the mastoid process is often resorted to in children, and the results, as far as my department is concerned, are, on the whole, extremely satisfactory. As regeneration is very slow, even in cases of simple resection, I have several times, about 10 or 14 days after the operation, when the swelling of the soft parts had entirely subsided, curetted the whole cavity slightly, and allowed it to fill up with a clot of blood and then made secondary suture. These experiments have given most encouraging results, the after-treatment, in the majority of cases, being considerably curtailed. If secondary suture is not performed the after-treatment in cases of simple resection is, as a rule, of very long duration (on an average  $2\frac{3}{4}$  months), partly because the cavity to be filled by formation of granulations is so large, and partly because there are comparatively

often intracranial complications. Relapse is not infrequent (3 of the 78 cases of simple resection in acute middle ear sup-puration).

#### RESUMÉ.

1. Subperiosteal abscess in the mastoid region is a fairly frequent otogenic complication, especially associated with early childhood.
2. Suppuration of the middle ear causing the disease is frequently acute, and the abscess appears at a very early stage, especially when the patients are young children.
3. It nearly always arises in connection with an osteitis in the mastoid process, and this osteitis is, as a rule, acute, even when the chronic osteitis already exists.
4. If there be a chronic osteitis in the mastoid process it will very often be found to be of cholesteatomatous nature.
5. The osteitis in the mastoid process accompanying the subperiosteal abscess in the mastoid region is generally very extensive and comparatively often complicated with intracranial troubles, especially diseases in and about the sigmoid sinus.
6. Wilde's incision for subperiosteal abscess in the mastoid process is, as a rule, absolutely inadequate. Simple resection of the mastoid process or radical resection of the middle ear should always be performed.



## XXXIV.

### OPERATIVE PROCEDURE FOR BRAIN ABSCESS OF OTITIC ORIGIN.

BY L. W. DEAN, M. S., M. D.,

IOWA CITY.

Two years ago I reviewed my experiences with brain abscess of otitic origin. They were most disheartening. My patients had not died of meningitis, following the operation, but it seemed to me had died mostly from conditions the result of my operative procedure. The operative technic that I had used up to this time is described in Case 1. A long incision was made in the dura or a flap of the dura was elevated similar to that which we now use in decompression operations. The abscess was opened by a wide incision, explored with the finger and irrigated. My cases of brain abscess had been very few in number. They developed an infected hernia of the brain, which it seemed to me was just as serious as the original condition. I had followed the technic as described in our textbooks in the operation. I also attempted the removal of the hernia by procedures recommended in these books, but without success.

Two years ago I decided to try various methods of opening and draining these abscesses. The results of this work are included in this paper. Some of the cases operated were apparently hopeless, but were operated perhaps because of MacEwen's dictum that abscess of the brain cases should die operated. One life I know was saved that was considered by all who saw her a hopeless case.

I realize that there is much to criticise in this work. I offer it simply to show what may be the results of various procedures used.

CASE 1. Mr. B., coal miner, age 35, referred by Dr. C. B. Taylor, of What Cheer, March 23, 1906. Family history was

negative. Patient had never had syphilis. For several years he had suffered from chronic otorrhea. Several days before I saw him his ear began to discharge freely; temperature ranged from 100 to 104 degrees. Examination revealed much tenderness over the mastoid. There was a moderate discharge of pus; fundi, pupils and reflexes were normal.

A tympanomastoid exenteration was performed. The mastoid was necrotic. Neither dura or sinus was exposed. The roof of the antrum and tympanic cavity were intact.

The second day following the operation the patient slept so soundly for four or five hours that when aroused he would remain awake but fifteen or twenty minutes and then go to sleep again. He was examined carefully, but no other suggestion of intracranial complication was found. Temperature was 103°. Administration of a laxative was followed by a reduction of temperature to 100° and a disappearance of his drowsiness. The next morning he was walking about the hospital. Seven days after the operation the patient returned home. His temperature remained about 100°. He complained of pain on the side of his head.

On April 10th he slept all day. On waking he was not sound mentally. On April 12th I saw him again. He staggered a trifle while walking. He could not tell the name of any person, not even his wife or brother. He knew them, but could not call them by name. He knew which name belonged to each person.

I gave the patient pen and paper and ask him to write the sentence I gave him verbally. He could not do so. I next gave him a printed sentence to copy, which he did, printing it. When asked to read what he had copied, he could not do so. Ocular, patellar reflexes, etc., and eye grounds were apparently normal.

The operative wound seemed clean. Patient was placed in the hospital for observation.

His temperature remained about 100°. The patient walked about, smoked and did things as usual. He was somewhat irritable. Mentally he seemed to be all right, except for his memory of words. His lapse of memory for nouns was most noticeable. His memory for verbs and adjectives, etc., seemed to be fairly good.

After a few days in the hospital the patient went home.

He returned May 25th. He now presented the symptoms as before. In addition there was a double optic neuritis, vomiting, and motor disturbance in the right side. Immediately following the mastoid operation an exploration of the temporo-sphenoidal lobe was advised. Consent was secured only at this late date.

*Operation.*—On May 26th the patient was operated. The middle fossa was opened one and one-fourth inches above the external auditory canal. The opening in the bone was one and one-half inches in diameter. The condition of the dura over the tegmen antri and tegmen tympani was investigated. It seemed normal.

A semicircular flap of the dura was elevated. The flap was one and one-half inches long and one inch wide. The finger was introduced between the dura and the brain, and the region of the petrous portion of the temporal bone carefully examined. No softened area could be detected. A knife was introduced at right angles to the surface of the brain. Pus was found. About two and one-half ounces was removed. An incision in the cortex one inch long was made. The abscess cavity at the point of opening the dura was separated from the brain tissue by approximately one-half inch of cortex. The abscess cavity was cleansed, using the finger. Two drainage tubes were inserted and the wound dressed.

The patient recovered nicely; the pulse, which was 66 before the operation, increased to 88. The next morning his memory for words seemed normal. He told me that it was exasperating preceding his operation. If he wanted a cigar he knew just what he wished, but could not think of the name. That, he said, made him irritable. The patient improved nicely for three days. Then his temperature went up to 104°. A second abscess in the roof of the first was opened. This was done without the least pain, without the use of an anesthetic.

His temperature returned to normal in two days and remained there until June 16th, twenty-two days after the operation. During this time the patient was a walking patient. He had a large fungus-shaped hernia of the brain. It was soft, infected and possessed of an odor quite characteristic. Various procedures were resorted to in order to get rid of

this. Caustics were used. It was cut away in part. It was unclean and could not be covered by a plastic. The abscess cavity had ceased to discharge and drainage tubes had been removed on June 5th. On June 16th patient developed meningitis and died a few days later. At this time the original abscess cavity and neighboring parts were opened and no pus was found. The meningitis may have been due to efforts that were being made to obliterate the hernia. No postmortem was secured.

CASE 2. J. J., farmer, age 35, referred by Drs. Thielen and McDowell, of Grundy Center, November 11, 1907. Family history negative. No history of syphilis. Patient says whenever he had cold his right ear discharged. For two weeks he had not been feeling well, but had continued working in the cornfield until the day before. For three days had great pain in the right side of face. Temperature on morning of November 11th was 100°, evening 103°.

*Examination.*—Right ear discharging abundant foul-smelling pus. No pain over the mastoid. Patient's gait was unsteady. There was optic neuritis. For the last few hours the patient's mental condition had been getting poor. His memory was especially deficient.

During the night patient became delirious and remained so. The next morning there was marked rigidity of the muscles of the neck.

*Diagnosis.*—Abscess of the brain with meningitis.

*Operation.*—A tympanomastoid exenteration was performed. The bone overlying the antrum and tympanic cavity was perforated. There was a large extradural collection of pus. Not overlying the antrum, but internal to it, approximately one-half inch, was found a blackened area of the dura, in the center of which was a perforation from which pus was escaping. The opening in the dura was not enlarged. A piece of gauze was pushed up into the abscess cavity. The mastoid cavity was packed lightly and the wound left open. Moist dressings were applied. The patient died the next morning.

*Postmortem Examination.*—An abscess cavity was found in the temporosphenoidal lobe. Extending from it to the surface



of the brain was a distinct sinus from which (Photograph 1) pus was passing to and through the opening in the dura. This shows the exact condition which I have designated as abscess with discharging sinus. There was a suppurative meningitis.

This patient presented two interesting things. First. The patient must have had the abscess for a long time without any manifest symptoms. Second. This was the only one of the few abscesses with discharging sinus I have operated upon that have not recovered. The cause of death in this case was evidently meningitis, which was present before the operation. I use the term abscess with discharging sinus in this paper to indicate one where there is a perforation in the dura through which the abscess is discharging. This is connected with the abscess, as in this case, by a tubular canal, or the abscess cavity may extend to the dura at this point. In some of the cases reported later as brain abscesses there may have been only a large subdural abscess. Unless an instrument is passed into the cavity—and it is not advisable to do this—the extent of the pus cavity cannot be determined. I am under the impression that in most cases of any marked extent the cortex of the brain, at least, is also involved.

CASE 3.—J. D., farmer, age about fifty, was referred to me by Dr. Shuell of Parnell on April 23, 1908. Six weeks before he was injured in a runaway. He was dragged one-quarter mile by his team. His head struck a telephone pole. The injury was over the upper part of the right mastoid. For two weeks he was confined to bed. After this he attended to the details of his farming. Two days before I saw him he developed a severe pain in the right side of his head. I found the patient in a comatose condition. Reflexes were slow. On each side was optic neuritis.

A diagnosis of brain abscess was made.

A very bad prognosis was made and operation decided upon. A large triangular piece of bone was found depressed. The base was the upper portion of the mastoid. The apex was in the squamous portion of the temporal. This piece was about one and one-half inches long. The base was one inch wide. The apex was most depressed and had penetrated the dura. On removing the bone a discharging sinus in the dura was left. Starting from this point and extending downward an incision one and one-half inches long was made in the

dura and brain cortex. An abscess cavity containing about two ounces of pus was opened. This was cleansed, using the finger. This was packed with iodoform gauze and the external wound left open.

This cavity was packed daily. The patient recovered sufficiently to be about the house and yard and superintend his farm.

On May 25th he was brought to Iowa City. An enormous cerebral hernia was present. At the upper and lower portions of the hernia was a softened area. Each was opened and in each a little pus was found. The hernial mass seemed to be infected. Sixteen days later the patient died with symptoms of meningitis.

CASE 4.—Mrs. C., housewife, aged thirty-three, referred by Dr. Sams, of Clarion, April 24, 1908. Family history negative. No history of syphilis. When a child had much ear-ache. Noticed a discharge from her left ear for the first time eleven years ago, when first child was born. Since then ear has discharged several times. Present attack began two weeks before with buzzing and pounding in the left ear. This was preceded by an attack of grippe. The buzzing in the ear was accompanied by some pain and discharge of foul-smelling pus.

Examination of patient showed: Left ear discharging foul-smelling pus. Much pain over the mastoid. Positive Romberg. Patient had a rolling gait. Temperature ranged from  $101^{\circ}$  to  $105^{\circ}$ .

On April 25th a tympanomastoid operation was performed. There was no change in the patient's condition. The patient was watched for four days. The temperature was fluctuating, ranging from  $98\frac{1}{2}^{\circ}$  to  $104\frac{1}{2}^{\circ}$ . Nystagmus made its appearance.

On April 30th the patient was reoperated. A septic clot was found below the knee. This was removed and the sinus opened above and below the clot. A well marked localized meningitis was found posterior to the ascending limb of the sinus. A small incision was made in the dura and the cerebellum punctured. The first two punctures gave no results. The third, at a depth of one and one-half inches, produced pus. About two drams of pus came away. It was fluid

white. The abscess cavity was packed carefully with a strip of sterile white gauze and a moist dressing applied. Instead of repacking, this strip was pulled out little by little each day. The patient's nystagmus disappeared. Temperature continued from 100° to 103°. Ten days after the operation the patient became restless. Temperature would rise and fall suddenly from 99° to 104°. Nystagmus and strabismus developed. A second cerebellar abscess was opened without anesthesia and packed as before. For the first time since the patient entered the hospital the temperature returned to normal. The nystagmus and strabismus were immediately improved and disappeared. Five days later temperature rose to 103°. For three days it oscillated from 98° to 103°. Nystagmus appeared again. A third abscess in the cerebellum was opened without any anesthesia. The temperature fell immediately below 99° and did not go above 99.5° for thirty-seven days, when the patient left the hospital cured. Patient has had no trouble since.

CASE 5.—Miss B. S., school girl, age nineteen, was seen in consultation with Dr. Whiteis of Iowa City.

One year before she had had tonsillitis, with earache in the left side, but no discharge from her ear. Several months after she developed pain in the side of her head. An otologist was consulted and a diagnosis of hysteria made. When I saw her she had a terrific headache, slight pain on pressure over the mastoid, temperature of 100°. Drumhead was normal. Retinal veins were dilated and there was a suspicion of optic neuritis. No motor disturbances. A mastoid operation was advised. Several days later a mastoidectomy was performed. I was not present at the operation, but the report was that there was evidence of chronic trouble in the mastoid, but no pus was found. This had no effect on the patient's temperature or pain. Two days after the operation I saw the patient with Dr. Whiteis again. Temperature was 102°. Patient was delirious. She recognized no one. Optic neuritis was present on the side operated. Reflexes on the opposite side of the body were increased. There was some rigidity of the muscles of the neck.

The patient was seen by Dr. Van Epps. A diagnosis of brain abscess with beginning meningitis was made. A very bad



prognosis was made and operation not urged. The father was very desirous of an operation.

The same day, assisted by Dr. Whiteis, the patient was operated. The brain cavity was exposed one and one-half inches above the external auditory meatus. The brain here seemed normal. The bone was removed downwards and inwards, removing the roof of the antrum and tympanic cavity. Here, between bone and dura, was found a collection of pus under pressure. Internal and posterior to the roof of the antrum was found a darkened area of dura, in the center of which was a discharging sinus. The dura was not covered externally with granulations. I decided to apply moist dressing and, if necessary, later increase the size of the dural opening. The conditions impressed me that the pus between dura and bone had been present only a few days. That the dural opening was recent. There was no perforation in the roof of antrum or tympanum that I could find.

The next day the patient's temperature was normal and mental condition excellent. Recovery was uneventful.

CASE 6.—Mrs. K., housewife, age about thirty-five, was referred to me by Dr. Meyer, of Gladbrook, October 15, 1908.

Two weeks before the patient had given birth to a baby. Since then she had been complaining of loss of vision and severe headaches. Patient had had a discharging ear on the right side for years. Examination revealed a chronic otorrhea on the right side. Optic neuritis was present. There was a left-sided paralysis of the seventh. Urine and physical examination was negative.

A diagnosis of abscess in the temporosphenoidal lobes of the right side was made. The patient was moved to the hospital, and on October 16th was operated. A tympanomastoid exenteration was performed. The dura was exposed above the external auditory meatus and over the mastoid, antrum and tympanic cavity. It seemed normal. About one inch above the meatus a knife was plunged into the brain so as to penetrate just below the motor area. The opening in the dura was only one-half inch long. No pus was secured. Feeling sure it was there, a brain explorer was introduced, its arms separated and about two ounces of thick pus escaped. Without removing the instrument, a narrow piece of sterile gauze was



packed into the brain cavity lightly and moist compresses applied. The day following the operation and for five days after the patient's condition was the very best. The abscess cavity was clean. The technic of this operation was what I consider the very best and a recovery was anticipated. On the fifth day the patient had a sudden terrific hemorrhage. The blood came from the wound cavity. It saturated the bandages and pillow. The patient died in seven minutes. Evidently a large vessel had ruptured. There was no post-mortem.

CASE 7.—Mrs. T., housewife, aged twenty, referred by Dr. Baker, of Stamwood, Iowa, May 26, 1909.

Six weeks before, as the result of a cold, patient had pain in left ear. Ear discharged for one week freely, then gradually ceased and had been dry for two weeks. There was then pain in the left side of the head, mastoid tender on pressure, temperature 100°.

Mastoidectomy was performed. A large extradural abscess was found on the middle fossa. The dura was covered with granulations. On searching the surface of the dura with the mastoid seeker a small hole in the dura was found. Pressure in the neighborhood produced but little flow of pus. There seemed to be a very small subdural abscess. Moist compresses were applied. Recovery was uneventful.

CASE 8.—Miss P., age sixteen, was referred to me in 1909 by Dr. Donovan. Patient had recently had measles, with a suppurative ear on the left side. The patient was unconscious, temperature 104°, pupils irregular, muscles of neck were rigid.

A diagnosis of meningitis of otitic origin was made. The mastoid was opened; the cells contained pus. On exposure of the dura it was found reddened and bulging. The dura was incised, with the expectation of performing subdural drainage. The brain tissue bulged into the opening to such an extent that ventricular puncture was decided upon. In attempting this puncture a subcortical area of softening was discovered. The cavity was packed lightly with sterile gauze. Some pieces of gauze placed between the meninges and moist compresses applied. Patient was not relieved and died the following day.

CASE 9.—Leonard K., school boy, age fourteen, referred by Dr. Bradley, of Esterville, July 27, 1909. Family history negative. Had much earache when a baby. Right ear had been discharging almost constantly since four years old. For two years the left ear had been discharging. Dr. Bradley had removed polyps from left ear three weeks before I saw him and another one week before. For the last three weeks patient had had pain in the back of the head and frontal region. He complained of being cold and had had a number of chills. Left ear was discharging. The tympanic cavity was filled with polyps. On July 24 patient was stupid. Dr. Bradley had made a diagnosis of brain abscess before sending him to Iowa City. Dr. Van Epps reported that there was no paralysis, irregular motor disturbances or other evidences of brain abscess. The fundi showed the retinal veins dilated, but no manifest swelling of nerve head.

On July 27th a tympanomastoid operation was performed. The mastoid was necrotic. The lateral sinus near the knee was exposed and covered with granulations. Before the operation T., P., R. were 96°, 50, 18. After the operation T., P., R. were 98.6°, 76, 18, and the patient began to clear up at once. He left the hospital August 7th apparently normal except for some deafness.

On August 11th his headache returned and he became somewhat stupid. Dr. Van Epps again examined the patient. He reported: Patient somewhat dull. Reflexes, station and gait normal. Blood examination 9000 whites and polynucleosis of 72%. Temperature ranged from 99° to 102°.

Ocular examination: O. D. pupil three and one-half millimeters; O. S. pupil three millimeters. Marked optic neuritis, with some diminution of vision in left.

On August 2, 1909, the middle fossa was exposed one and one-half inches above the external auditory meatus; the bone was removed down to the tegmen antri. An incision one-half inch long was made in the dura, one inch above the roof of the antrum. On opening the dura no fluid escaped. About three ounces of foul-smelling pus was removed. A second opening was made one inch lower, because the cavity was found so large, and a drainage tube was inserted in each.

The pus contained staphylococci and diphtheria-like bacilli. After the operation the patient's temperature fell to 99°

and remained under  $100^{\circ}$  for seven days, when it rose to  $101\frac{1}{2}^{\circ}$ .

Then the boy's normal condition, which had been the very best, became dulled again, and a second abscess, posterior to the first, was opened and drained.

The temperature continued to vacillate from  $98^{\circ}$  to  $100^{\circ}$  after this. At times the boy was stupid; otherwise he seemed to be all right. On September 3rd, three weeks after the operation, he died suddenly without elevation of temperature; the pulse becoming exceedingly rapid, with respiration diminishing.

The postmortem showed a rupture of the abscess in the lateral ventricle. The following is the report of the postmortem examination made by Prof. Albert:

In the posterior portion of the inferior or third temporal convolution were two openings, apparently artificially made, leading to a suppurative process within. These two openings were about an inch apart, one slightly above the other. A cross section of the brain was made anterior to these openings, which demonstrated the existence of two distinct circumscribed collections of pus, separated by about one-fourth of an inch. One of these extended to within one-eighth of an inch of the external surface and produced a distinct bulging. A section made one inch anterior to the one just mentioned showed the two areas of pus still more widely separated—in this case one inch. The area near the surface was three-eighths of an inch in diameter and extended to within one-sixteenth of an inch of the surface. Just posterior to this area is an area of dense tissue—more dense than brain substance in consistency, of a translucent appearance, with the exception of a strip about the center, which is of a yellowish white color. A section of this tissue was taken for microscopic examination.

The other abscess measured one-half inch from above downward and one inch from side to side. It extended to just beneath the lateral ventricle. The surface of the lateral ventricle, just adjacent to it, was found to be inflamed and the ventricle itself to contain a slight purulent exudate. Another section was made from the brain, about three-fourths inch anterior to the last one, and which cut through the optic chiasm. This section revealed the presence of a considerable



amount of pus in the descending horn of the lateral ventricle. A section made one-half inch anterior to this revealed the presence of pus in the white substance separating the fibers anterior to the anterior end of the descending horn of the lateral ventricle. This continued anterior for another inch or to within two inches from the anterior end of the brain. The internal capsule was not involved at any part. It will, therefore, be seen that there were two abscesses, the smaller one about one-half inch in diameter and two and one-half inches in length. This one remained near the surface of the lower temporal convolution and led to the purulent localized inflammation of the meninges covering that portion. The other abscess began posteriorly two inches anterior to the posterior end of the brain, opening posteriorly through the artificial opening made into the middle or second temporal convolution and extended anteriorly and inward just beneath the lateral ventricle for a distance of about two inches, when it was continued anterior in the descending horn of the lateral ventricle, and extended some distance anterior to the anterior end of the descending horn, as already described, making in all a process four inches in length.

*Microscopic Examination.*—1. Portion of brain from inferior temporal lobe from a section made from the brain about one inch posterior to the optic chiasm. The greater part of the pathologic area consisted of subacute and partly chronic fibroplastic proliferation, along the center of which was a linear area which had undergone hyaline degeneration; to one side were a large number of pus cells (abscess).

2. Exudate from descending horn of lateral ventricle taken from section of brain cut through optic chiasm, or about one inch anterior to the section from which No. 1 was taken. Exudate consisted entirely of pus.

3. Section of brain with some exudate recognizable to the naked eye taken from the white substance of the temporal lobe anterior to the anterior end of the descending horn of the lateral ventricle. The exudate, which had separated some of the brain fibers, consisted entirely of pus.

It is interesting to note the chronic fibroplastic proliferation with the hyaline degeneration. This shows a strenuous effort on the part of the organism to overcome this condition. It



also shows that this pathologic process must have been present for a long time. The absence of motor disturbances in such a large abscess is also noteworthy.

CASE 10.—Mr. M., farmer, age sixty, was referred to me by Dr. Myler, of Lebanon, S. D., on August 11, 1909. In April last patient suffered from la grippe, with pain on the right side of his head. At no time had there been a discharge from his ear.

Examination showed drumhead slightly reddened. Mastoid region little edematous and painful on pressure. Ocular and general examination negative. Patient was much emaciated and weakened.

A mastoidectomy was performed. The whole of the mastoid was diseased. There was a perforation of the inner table of the middle fossa and a large extradural abscess. After thorough removal of the bone a large perforation of the dura was found. It was large enough to allow the passage of the handle of the scalpel. This opening was covered by a mass of granulations. Pus continued to discharge through this perforation. The handle of the scalpel was introduced one inch in the opening. It gave the impression that there was a large superficial cavity.

A little gauze was packed in this cavity and moist compressed applied. The cavity was packed daily for one week; then, the discharge having ceased, it was left out. Patient recovered.

CASE 11.—E. E., school boy, age sixteen, was referred to me by Dr. McLaughlin, of Washington, Iowa, on November 24, 1909. When two years old he had scarlet fever, with abscess in left ear. This was accompanied by an abscess back of the ear. About one-half of the time since, the ear had been discharging. Recently he had been having very severe pain on the left side of his ear. Physical examination negative. Retinal veins in the left eye were distinctly dilated. Blood count—leucocytosis 26,600, polynucleosis 65%. Temperature 99° to 100°.

A tympanomastoid operation was performed. The bone over the dura of the middle fossa and over the lateral sinus was necrotic and perforated. The sinus was covered freely with granulations, as was also the dura in the middle fossa. There

was a large extradural collection of pus. Above the lateral sinus at the knee was a place where pus continued to ooze up through the granulations, which were very abundant here. Pressure on the dura in the neighborhood caused a flow of more pus. A diagnosis of brain abscess was made. The perforation of the dura was so large that the handle of the mastoid seeker could be readily introduced. This was passed in at right angles to the surface of the dura a distance of one and one-half inches, indicating a rather large cavity.

A strip of gauze was passed into this cavity about one and one-half inches and moist dressing applied and the wound left wide open. For one week this sinus discharged. A piece of gauze was introduced daily as long as there was any discharge. One week later the wound was closed by a plastic operation.

Recovery was uneventful.

#### CONCLUSIONS.

1. The opening of the dura should be such as to prevent, if possible, a hernia of the brain. A hernia once formed is almost impossible to get rid of. It is also very difficult to ever get in clean, so as to allow of its being covered by a plastic operation. In cases 1 and 3 this hernia seemed to be the ultimate cause of death.

The incision in the dura should not be more than one inch long. One-half inch is usually long enough. This will allow of all the manipulation that should be done. It allows the introduction of a narrow strip of gauze into the wound cavity and the daily changing of the drain.

It is better to run the slight risk of getting poor drainage than to get a large hernia.

2. In every case of brain abscess a discharging opening in the dura should be sought for. If found it may be stretched, but the dura should not be cut. If nature has been holding this process in check without an opening in the skull and none or little drainage, with a free exit from the sinus, a little gauze drain, to keep it open, and a moist dressing, to readily absorb the discharge, nature should and usually does overcome this process. The nature of the brain tissue is such that it tends to collapse and force the pus from the sinus if present. Six of the cases reported had discharging sinuses.

Case 2 died because meningitis was present before the operation.

Case 3 died, I think, because of incising the dura and getting a hernia. This case I would now treat by simply placing a piece of gauze in the sinus, and applying moist dressing. If necessary, the brain can be cut open later.

Around this discharging sinus at its dural opening nature had formed protective adhesions which should not be disturbed. The wall of the sinus in the brain is a good, protective one and should not be injured in passing gauze. The photograph accompanying Case 2 shows these conditions nicely.

3. The prognosis in brain abscess is much influenced by whether a discharging sinus is present or not. That is, whether nature has performed the operation on the brain or not. In my few cases seen later in this series I have made a good prognosis. In two cases, Cases 10 and 11, this was done when visiting physicians considered the cases hopeless. Recovery in each was uneventful. This sinus is not always easy to find. In Case 2 it was located inwards so far as to make its discovery difficult.

The size of the abscess has much to do with the prognosis. I doubt if any procedure would have drained Case 9 so there would have been recovery.

4. Manipulation of the wound. The advantage of exploring an abscess cavity with the finger or instruments will not compensate for the damage done to the limiting wall of the abscess cavity and the making of a large opening with danger of hernia.

Most secondary abscesses following operations I believe to be due to this cause.

I prefer to explore the brain with brain explorer with separable arms. When pus is found the gauze should be passed between the arms of the instrument and the instrument withdrawn, leaving the gauze in position.

5. Drains. The use of tubes for drainage has seemed to me to result in damage of the limiting wall when the brain collapses. Tubes will stop up and must be changed. In my cases my assistant noted carefully the depth of the abscess and the direction of the puncture. Daily he has changed the

gauze. The new strip is slipped in by means of a blunt probe. The first few days, on removal of the gauze, a little pus will come away. As soon as this disappears the gauze is left out. The size of the gauze drain depends on the size of the abscess.

I realize that gauze is one of the best materials for draining. In abscesses of the brain the surrounding tissue exerts a constant gradual pressure. Feeling with the finger in an abscess cavity day after day, as I once did, demonstrated this nicely.

6. Exploratory puncture should not be made with a needle or narrow-bladed knife. In Case 6 if the brain explorer with separating arms had not been used the pus would not have flowed.





Abscess of brain (temporal lobe) secondary to chronic suppurative otitis media, showing discharging sinus.



## XXXV.

# THE RESECTION OF BONY DEFLECTIONS OF THE NASAL SEPTUM.

BY OTTO T. FREER, M. D.,

CHICAGO.

In almost all deflections of the nasal septum bone must be removed in order to obtain perfect breathing after a sub-mucous resection; nevertheless, experience has shown me that many operators take away only the cartilaginous portions of an osseocartilaginous deflection and leave its bony part to continue to obstruct the nostril. Before I appreciated the need of a complete removal of all deviated or thickened bone, I, too, sometimes contented myself with cutting out only the bent cartilage, always regretting my conservatism, and in several instances being obliged to perform an extensive bony resection in a second operation in order to obtain a satisfactory result.

The chief reason why bony deviations are so often left untouched is the difficulty of their removal, a difficulty increased by the insufficient access to the operative field obtained in some methods of operation. In addition, the fear of making a perforation during the denudation of the bone deters many from resecting it, especially that portion called the ridge, after the cartilage has been successfully removed. The thick periosteum which envelops the ridge may hide it so completely that operators may, as I have seen, fail to find it at all.

While my earlier bony resections proved difficult, changes in the technic have made those of my later work so uniformly satisfactory and free from perforations that I have been impelled to describe in this article my present method of the removal of bony deflections.

Much of the difficulty experienced by operators in taking away the bony portion of deviations lies in an imperfect conception of the often confusing anatomic peculiarities of the skeleton of deflections, and for this reason the surgical portion

of this paper is preceded by some anatomic description of the chief divergences from the normal presented by bony deflections in my series of 428 cases.

#### ANATOMIC PECULIARITIES OF BONY DEFLECTIONS.

In this description, for the sake of convenience, the bony wall arising from the nasal floor created by the blending of the anterior portion of the vomer, the incisor crest and superior maxillary crest is designated collectively by the customary term of "the ridge," used above.

One of the most striking of the anatomic divergences found is the displacement of the septal cartilage from its proper position on top of the ridge to an attachment to its side (Fig. 1), so that the cartilage overlaps the bone. In the normal straight septum the inferior angle and posterior inferior border of the quadrangular cartilage of the septum rest vertically upon the narrow, rough and often channelled anterior border of the vomer and superior border of the incisor crest, which form the top of the ridge, the quadrangular cartilage, growing in proper proportion to the bony frame containing it, standing centrally and vertically upon an upright ridge (Fig. 2<sup>1</sup>). In nontraumatic deflections, however, the cartilage either grows too fast for its bony frame, and so becomes too large for it, or else the frame stays too small. Under both these conditions the cartilage distorts the frame by pressure, bending out its margins by the wedging force of its growth, so that the vomer, incisor crest and perpendicular plate, with which the cartilage articulates, are bent outward, the ridge becoming inclined toward the nasal floor and, in curving over, causing the rough articular surface upon which the cartilage rests to look to the side, instead of upward. At the same time, the pressure of the growing cartilage spreads this articular surface by forcing downward the one of its margins which comes lowest in its new position, the osseocartilaginous synarthrosis between the cartilage and ridge thus becoming not only displaced from the top to the side of the ridge, but also greatly widened (Fig. 2<sup>3b</sup>). The lower boundary of the so displaced and broadened rough articular surface develops into the sharp bony ledge so often sawed off as an exostosis, this ledge being overlapped and covered by the cartilage which ends inferiorly in a sharp angle (Fig. 2, <sup>3c</sup>), corresponding to the apex of the ledge of bone. The overlapping of the cartilage



in the displacement and broadening of its synarthrodial articulation with the ridge is thus the cause of the cartilaginous covering found upon bony crests and ledges which have been sawed away, and it is my experience that almost all bony and cartilaginous ledges and crests are thus merely the horizontal angle of deflections in the naris of the convexity.

The tilting over of the articulation between cartilage and ridge, together with its broadening, necessarily places the sharp horizontal angle or crest of the deflection in the naris of the convexity at a lower level than the groove of the concavity in the other nostril (Fig. 2<sup>3</sup>g). For this horizontal angle corresponds to the lower margin of the laterally displaced articular surface, while the groove of the concavity marks exactly its upper margin—that is, the position of the anterior border of the vomer. For this reason even after the cartilaginous deflection, including the cartilaginous overlapping described, has been entirely extirpated, the groove of the concavity indicating leaning over of the ridge into the other nostril will nevertheless be found to persist until, in addition to the cartilage, the deflected ridge, together with its tilted articular surface, is cut away to the bottom. Only when this has been done will the groove of the concavity be found effaced. It is my experience that until it be effaced, the obstructed naris of the convexity has not been sufficiently freed to insure perfect breathing after the healing is complete. Very often the bent-over ridge in the naris of the convexity lies so near the nasal floor that it is overlooked, unless the operator heed the indication of its presence given by the persisting groove of the convexity higher up in the other nostril. If he finds the groove present, he should, therefore, seek and resect the concealed ridge.

The overlapping of the ridge by the cartilage almost always takes place in the naris of the convexity of the deflection: but I have found a few instances where the overlapping occurred in that of the concavity, the cartilage, in forcing over the ridge, tilting its synarthrodial junction with it into the opposite nostril (Fig. 2<sup>4</sup>).

It is obvious that the placing of the cartilage beside the bone in the overlapping process doubles the width of the septum, which thus obstructs the nares by its thickness as well as its deviation. The removal of this excessive thickness, in

the submucous resection, is one of its greatest advantages over the fracturing operations, which leave it.

The overlapping of the cartilage, unless understood, is confusing; for the operator, expecting to find the yielding mucosa of the opposite naris underneath the cartilaginous deviation after its removal, is surprised when confronted by the resistance of the invisible bony wall of the ridge, hidden in its envelope of periosteum. The resection of this concealed bone may seem so difficult as to tempt him to leave it intact, to the detriment of his patient.

The arrangement of the periosteum and the perichondrium in bony deflections is also complex. These membranes do not merely form a continuous sheet upon one side of the septum, like paper on a wall, but both the ridge and the cartilage have their own periosteal and perichondrial envelopes, the periosteum of one side of the ridge crossing over its top into the other nostril, while the perichondrium also forms a separate compartment for the cartilage which envelops its lower border, thus making the perichondrium likewise continuous from one nostril to the other. (Fig. 2.) Externally the envelopes of the ridge and of the cartilage are united where they are in contact, and they are covered by a continuous sheet of mucous membrane in each naris. On account of this complicated arrangement of the two envelopes described, the elevation of the covering of one side of the septum may often be easily made with a dull elevator as far downward as the cartilage extends, but becomes impossible below this without a keen blade, because the bottom of the envelope of the cartilage has been reached, and that of the ridge has not been opened. To, therefore, attempt to forcibly bare the entire side of the septum with a dull elevator results in tearing the coverings of the septum along the line of the crossing of the periosteum into the other nostril.

While a deflected ridge almost always arches over and overhangs the nasal floor, this overhanging may be absent and the hollow space under the bent-over ridge may be filled out with bone, so that on the convex side of the deflection the ridge forms a straight wall, and yet the usual groove, indicating its leaning over, exists in the naris of the concavity. (Fig. 3b.) A ridge of this kind is necessarily wedge-shaped, and of great breadth at its base, thus depriving the bottom of

the naris of the convexity of a great part of its normal width. The condition is a very confusing one; for while the naris of the concavity presents the usual horizontal groove, or hollow, seen in a deflection involving the ridge, there is no evidence of the deflection in the form of a projecting angle in the other nostril, which seems very narrow, but has a straight bony septum. Ridges of this kind must be extirpated to the very bottom, in order to give normal width to the narrowed naris and place the septum in the median line.

A more frequent peculiarity, the opposite of a deflected ridge which does not overhang at all, is found in a ridge which leans over so excessively that it lies almost flat upon the nasal floor, so that the side which comes uppermost may even be taken for the latter.

While the ridge is commonly buried in tough, thick, firm, adherent periosteum, the posterior part of the bony deflection, formed by the junction of the vomer and perpendicular plate of the ethmoid bone, is usually easy to denude of its coverings. This posterior part forms a horizontal angle, which I have called the horizontal bony V (Fig. 4c, 5c), whose apex projects into the naris of the convexity toward the lower turbinated body, sometimes pressing firmly into it. The upper plane of the angle is created by the bent-out perpendicular plate, and below this usually by the broad articular surface of the displaced osseocartilaginous synarthrosis described, while the lower plane of the angle is created by the portion of the vomer arching over the nasal floor below the articular surface. (Fig. 4.) Attached to the rough articular surface, and following the side of the vomer, often far back toward its posterior border, is the overlapping portion of the cartilage of the septum, which appears in the form of a long strip characteristically indented on the surface which is united to the bone. (Fig. 4d.)

Instead of forming the acute angle of a horizontal V, the posterior part of the bony deflection may appear bowed, as a vertical capital C. The bone of the V or the C may be very thick and strong in front, but usually, some distance behind, the operator comes upon very thin, paper-like bone, into which the V merges.

The perpendicular plate of the ethmoid bone may be vertical in front and only deviated behind, where it joins the vomer



in the V. Not rarely, however, the deflection of the perpendicular plate reaches forward, projecting outward into the middle meatus and against the middle turbinated bone, along their whole length.

Unusual thickness of the bony parts of the septum may cause quite as much obstruction to breathing as their deflection. I have encountered ridges one-half of an inch, and perpendicular plates three-sixteenths of an inch in thickness. Even if straight, a very broad ridge should therefore be taken away, as after the resection of the cartilage it supports nothing, and its removal gives great space.

The proportionate area occupied by the cartilage and bone in a septum varies greatly. In some rare cases the septum is almost entirely of bone, the ridge rising to a great height above the nasal floor, the large perpendicular plate descending low, and the anterior border of the vomer being steep and coming far forward. The converse of this condition is presented by other septa, less rare, where the cartilage occupies an unusually large area, the margins of its bony frame receding before it, so that the anterior border of the vomer is found far back in the naris, and the perpendicular plate high up, while the ridge may be scarcely indicated.

Only the typical anatomic peculiarities of bony deflections have been mentioned here, the unusual ones not being described. The latter, however, all show in some measure their relation to the typical conditions.

#### THE RESECTION OF BONY DEFLECTIONS.

The surgical description in this article presupposes the completed resection of the cartilaginous portion of the deflection and the use of the author's reversed L mucosa-perichondrium flap, which gives the free access to the field of operation which is indispensable for the exact excision of the bony deviation. While foreign to the subject of this paper, the difficulty others have had in uplifting this flap and the fact that most operators do not understand its advantages, make a word in regard to its creation seem advisable, especially as I have improved upon the method of making it, previously described by me.

The making of the flap is begun with a horizontal incision, which follows the base of the septum close to the nasal floor, from a point to which it is intended the vertical incision shall



descend, well forward into the nasal vestibule, usually into the cutaneous portion of the septal covering. The uplifting of the flap (Fig. 6a) is begun from this horizontal incision by means of keen, round-bladed knives of suitable form, found in my set of instruments; for the coverings are always adherent along the bottom of the septum, so that a dull elevator should not be used. Often it is not possible to uplift the perichondrium together with the mucous membrane at the bottom of the intended flap, and in this event a little of the detached mucous membrane is uplifted alone at first in order to expose to view the perichondrium upon the cartilage, the perichondrium being then cut through with the blade and its elevation started. This permits the introduction of a dull elevator under the perichondrium and its ready detachment upward and backward to the intended site for the vertical incision, which is thus made after the detachment of the flap. The dull elevator is then withdrawn and a keen-edged one is introduced under the perichondrium in its place, and passed backward underneath it to the intended site for the vertical incision, which should be placed as far back on the septum as possible, regardless of the presence of a vertical angle of deflection in the cartilage. The sharp elevator is then punched through the covering at the site selected from beneath and made to cut up and down until the vertical incision is completed. This method of making the flap is preferable to the one of my older descriptions, as it permits the creation of a very large and untorn flap, which gives the widest access to the operative field. When completed the flap is uplifted forward to its base and then held out of the way with one of my retractors used by an assistant, who, with another retractor, pulls the wing of the nose outward. A third retractor, held by the operator, opens the nostril downward, the three acting as a trivalve speculum, as shown in the illustration.

After the resection of the cartilaginous deflection its remains, clinging to the ridge along the bottom of the septum, are to be pared away with the thin spatula blade of a sharp elevator, in order to expose to view all of the periosteum of the ridge on the side of the convexity. The cartilaginous strip described as extending backward upon the rough articular bony surface of the osseocartilaginous synarthrosis upon the side of the vomer must also be freed from its attachments and

removed. For this purpose a long, sharp elevator is used to separate the cartilage from the bone, and also to cut around the outer surface of the cartilage, to detach it from the mucous membrane of the convex side of the deflection, to which it is usually firmly united, a dull elevator being rarely able to free it. When disconnected from its surroundings, the cartilaginous strip may be drawn out with dressing forceps. It often extends very far back, and its removal may require patience.

The next step in the operation is to find the concealed ridge by feeling for it through its periosteum with a dull elevator, palpating with this upward from the floor of the nose until the position of the upper border of the ridge is made evident and outlined by the elastic yielding of the mucous covering of the side of the concavity of the deflection above it. The line of the upper border of the ridge having been thus determined, a cut following it is made down upon it from above to the bone (Fig. 7) with the round-bladed knife E of my set of septum instruments. (Fig. 8E.) This splits the periosteum along the whole length of the top of the ridge. The periosteum in the naris of the convexity is then pushed away from the ridge down to the nasal floor with a little raspatory (Fig. 8), whose blade is curved on the flat. This instrument is described in the *Journal of the American Medical Association*, December 4, 1909.

When this instrument has detached the periosteum from the top of the convexity of the ridge, it is directed backward along the base of the septum in order to denude upon the same side the lower plane of the convexity of the horizontal angle of the bony deflection, or V, this lower plane being represented by the deflected vomer overlying the nasal floor.

The next step is the detachment of the periosteum from the ridge and V on the side of the naris of the concavity. This must be done cautiously, for it is this portion of a submucous resection which, in my experience, is the most apt to create a perforation, the penetration into the other nostril occurring unexpectedly somewhere along the top of the ridge. Since employing the raspatory mentioned, I have been able to avoid this type of perforation entirely, and I regard this implement as a safeguard against the accident. In order to bare the side of the ridge in the naris of the concavity (other nostril) the raspatory, held firmly close to its cutting end, that it may not

slip, is made to progress cautiously over the top of the ridge and down its other side to the floor of the nose, the cutting edge hugging the bone. (Fig. 9.) The operator may always know from his sense of touch that he is maintaining bony contact, and, so long as he feels it, he may be sure that no perforation can occur. The raspator climbs over and down the other side of the ridge in a direction which crosses it as nearly as possible at right angles. When the ridge has been thus denuded upon both sides and lies bared to view, the raspator is directed backward into the hollow of the bony V, and the usually easy denudation of its concavity is completed. When the entire bony deviation seems detached from its coverings and ready for removal, the denudation should be carefully revised with the raspator and a dull elevator, in order to make sure that there are no regions where the coverings are still adherent. Such places are especially apt to exist near the nasal floor on the side of the concavity of the deviation and, if overlooked, generally lead to the tearing out of the attached piece of mucosa, and a perforation when the bone is removed.

The open view of the operative field offered by the reversed L flap, recommended by me, makes the freeing of the bony deflection under the guidance of vision possible everywhere, except along the invisible bottom of the ridge on the side of the concavity, and this perfect inspection of the line of advancing denudation is the best safeguard against tears and perforations. All the work requires minute and close seeing. The illumination is obtained from the Kirstein light, the only one I have found suitable for the near approach of the eye required.

While the periosteum of the ridge is, with rare exceptions, intimately united to it, that in the hollow of the bony V is generally very easy to uplift.

For the removal of the bone I employ the reinforced Freer-Gruenwald forceps (Fig. 8), described by me in previous articles, and the small chisel of my set of septum instruments. Many of the chisels suggested for the resection of the bone are too large, hence obstructing the view during their use, and their excess in width makes them liable to cut through the mucous coverings beyond the limit of the bony cut they are making. A V shape for the chisel blade is unnecessary, as the simple flat blade may be better controlled, may be kept sharp, and requires less propelling force.



Since I have reinforced the forceps I have never met with bone in the septum which it will not cut through with ease, the thickest I have used it upon being three-eighths of an inch thick.

The removal of the ridge I now always begin with the chisel, cutting along the floor of the nose, through the incisor crest and back under the vomer as far as it has no bony connection with the perpendicular plate above. Then by lifting the shank of the chisel the undercut fragment of bone breaks off at the rearmost end of the cut. In this manner all of the deflected or thickened ridge, as far back as the bony V, is taken out in one piece. I know that the chisel is also used back of this anterior portion of the bony septum to detach the bony V above and below, this detachment being followed by breaking out of the thus partly severed fragment with dressing forceps. But I regard this as a dangerous practice. The frail perpendicular plate in this portion of the bony septum is liable to be shattered by the chisel, and far-reaching fissures may be created by the breaking away of the fragment still attached behind. That this is no imaginary danger is shown by a case related to me by Professor Bernhard Fränkel and Professor Edmund Meyer, of the Charité clinic, in Berlin, in which blindness of one eye followed the breaking out of such a fragment in a submucous resection, a fissure having evidently traversed the sphenoidal sinus into the optic foramen. In another instance, of which Professor Koschier, of Vienna, told me, the entire vomer was twisted out of the nose, and recently I have heard of still another instance of this accident. It is permissible, in my judgment, to break out fragments of bone posterior to the junction of the vomer and perpendicular plate, if the bony V has been completely severed from its connections above by means of the punch forceps, and when the thus partly detached bone is found to be movable and obviously almost severed from its surroundings. In this manner I often remove the entire bony V in one piece. In the majority of cases, however, it is easy to cut out the V, piece by piece, with the punch, in a few minutes. Firm bone should never be broken out with seizing forceps. The fixed blade of the punch forceps is used as a guide in applying the forceps for its bite, this blade entering into narrow places, as where the bony V described presses into the inferior turbinat-



ed body, and must be wedged away from it with the forceps blade before the instrument may be applied to the bone. For this reason I regard both a right and a left opening forceps as a necessity in the operation.

Deflections of the perpendicular plate outward should be followed as high up as they extend toward the nasal roof. They are easy to excise with the punch, and their removal clears the middle and superior meatuses.

The actual excision of bony deviations seldom takes more than a few minutes; it is their denudation which requires time and care. The cutting away of the ridge is sometimes followed by free bleeding from the cut vessels of the bone. In all but rare cases, however, the hemorrhage during even the most extensive bony resections is insignificant, and sometimes almost absent. Bleeding hiding the field of operation is best controlled by an application of the flake crystals of pure cocaine, on a swab moistened with adrenalin, according to the method I employ for the local anesthesia.

In men the ridge is often very broad and thick, and strong blows of the mallet may be needed to chisel it away. The angle of the V and the perpendicular plate may also be very thick; but after these parts have been removed, a thin, egg-shell-like continuation of the deflection is usually found in the posterior part of the vomer, which may generally be taken away by twisting it out with the dressing forceps.

When all the bony deviation seems cut away, the flaps are to be replaced. If they lie down flat, the resection is complete; if not, the projecting fragment holding them away must be sought for and removed.

I have never known harm or a permanently flaccid septum to result from even extensive resections of the bone of the septum, and have never felt the need of inserting pieces of cartilage between the replaced coverings in order to stiffen the partition, as is recommended by Max Halle. In concluding this article, I advise a complete extirpation of bony deflections, to prevent the disappointment following an incomplete resection. For the after-treatment, I refer to my other articles on this subject. Much of what I have written here concerning the removal of bony deflections represents my later technic and is not to be found in my previous publications, a list of which is subjoined.

34 Washington Street.

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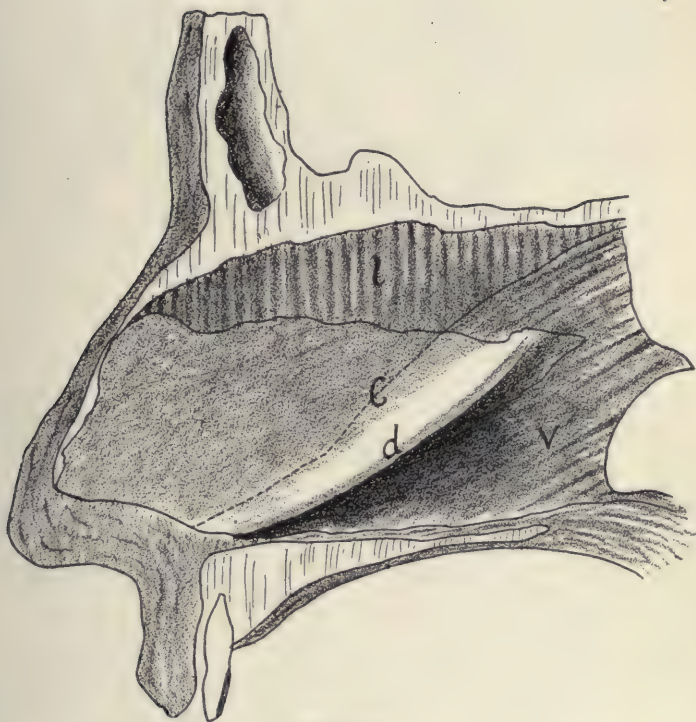


FIGURE 1.

Lateral view of the skeleton of the nasal septum. 1, Perpendicular plate of the ethmoid bone; v, Vomer; c, Cartilage of the septum overlapping the vomer upon the displaced articulation and ending in a sharp cartilaginous ridge, d.





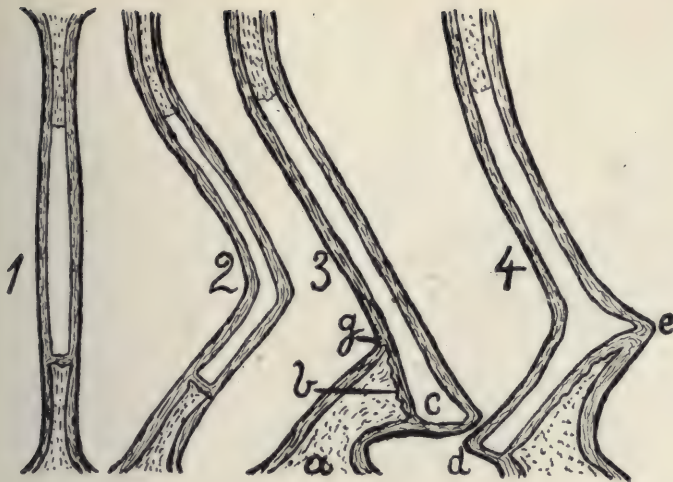


FIGURE 2.

Vertical section of the nasal septum about its middle. 1, A straight septum, showing the cartilage resting vertically upon the ridge; 2, A view of a horizontal angle of deflection as it would occur if the articulation between cartilage and ridge remained unaltered; 3, Actual changes in the articulation and structures of the deflected septum as they are commonly found; a, Overhanging ridge enveloped in its periosteum; b, The articular surface displaced into the naris of the convexity with the cartilage; c, Overriding the bone. The individual perichondrial and periosteal envelopes of the cartilage and bone are shown; g, Groove of the concavity of the deflection; 4, Exceptional overriding of the ridge by the cartilage in the naris of the concavity instead of the convexity, creating a ledge, e and d, in each naris.

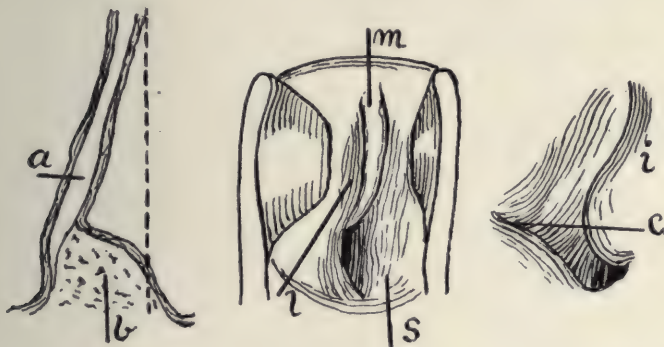


FIGURE 3.

a, Cartilage of the septum laterally attached to ridge, b, which does not overhang. The dotted line shows median position the septum should occupy after the resection. l, Inferior turbinated body; m, Middle turbinate; s, Vertical wall of ridge in narrowed naris; c, Groove of concavity in open naris; i, Inferior turbinate.



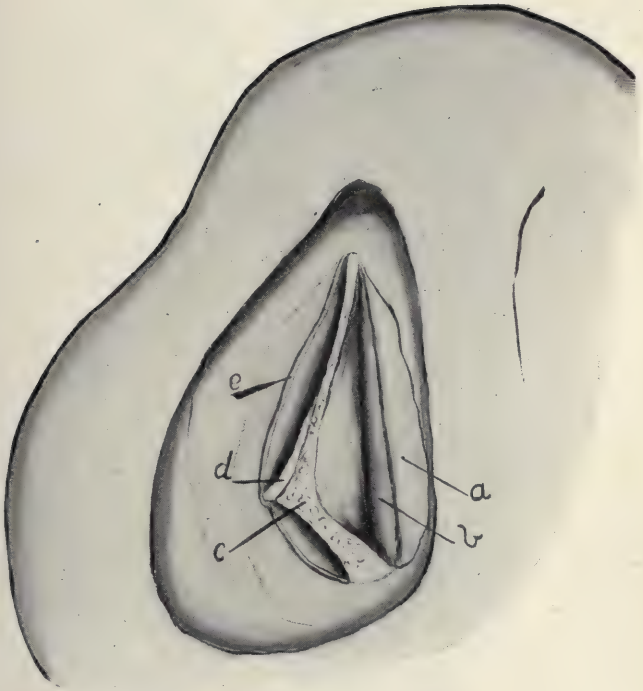


FIGURE 4.

View of the horizontal bony V, or angle of deflection, pressing into the right inferior turbinate. a, Anterior reversed L flap; b, Inner surface of mucous covering of the concavity; c, The bony V; d, Overlapping portion of the cartilage of the septum extending backward upon the side of the vomer as a cartilaginous strip; e, Detached portion of the mucosa of the convexity, which lies behind the L shaped flap.





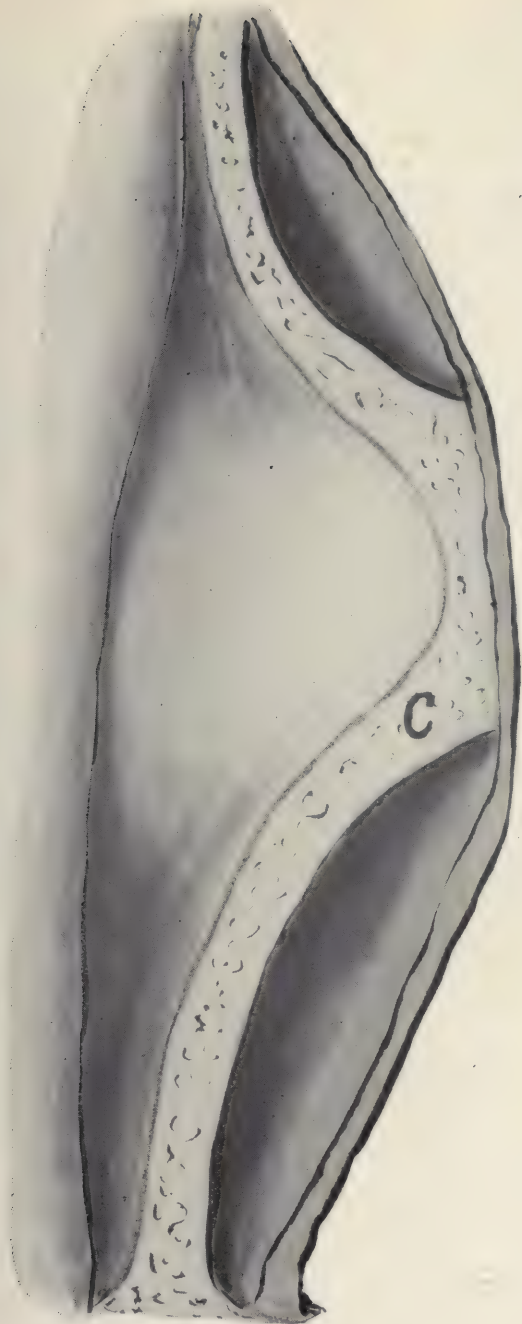


FIGURE 5.

Horizontal bony V, c, denuded ready for cutting away.



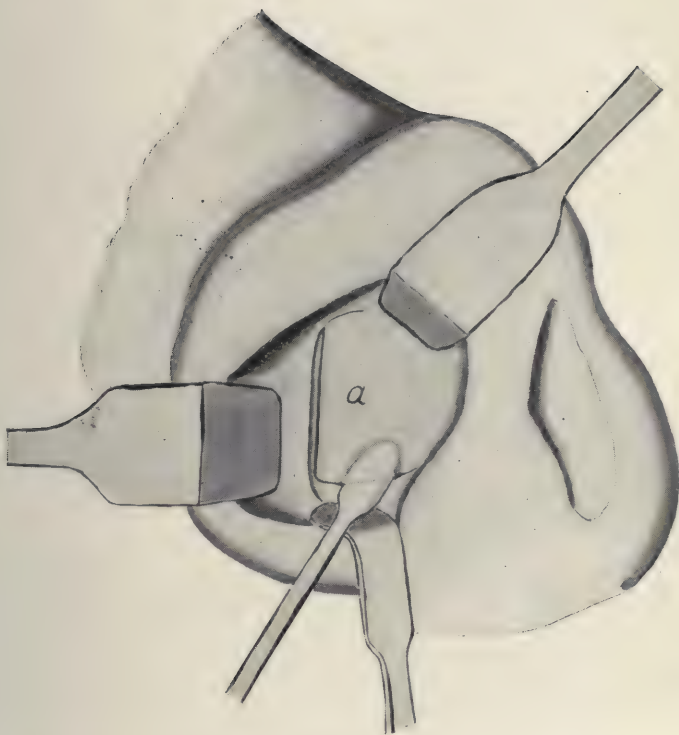


FIGURE 6.

The right nostril is held open with retractors. The reversed L flap, a, is being elevated from the cartilage from its bottom with the roundbladed knife.





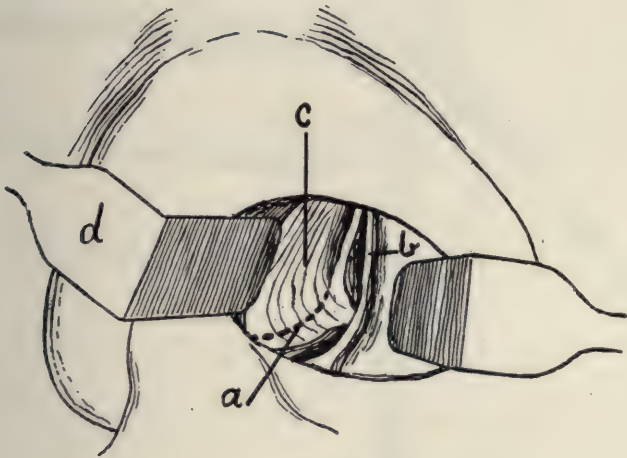


FIGURE 7.

The left nostril is held open with retractors. Ridge, a, concealed in its envelope of periosteum; the dotted line shows the incision which splits the periosteum along the upper border of the ridge; b, Cut edge of the uplifted mucous covering of the posterior part of the deflection; c, Perichondrial surface of the mucous covering of the opposite nostril (naris of the concavity of the deflection); d, Retractor holding forward the anterior (reversed L) flap.



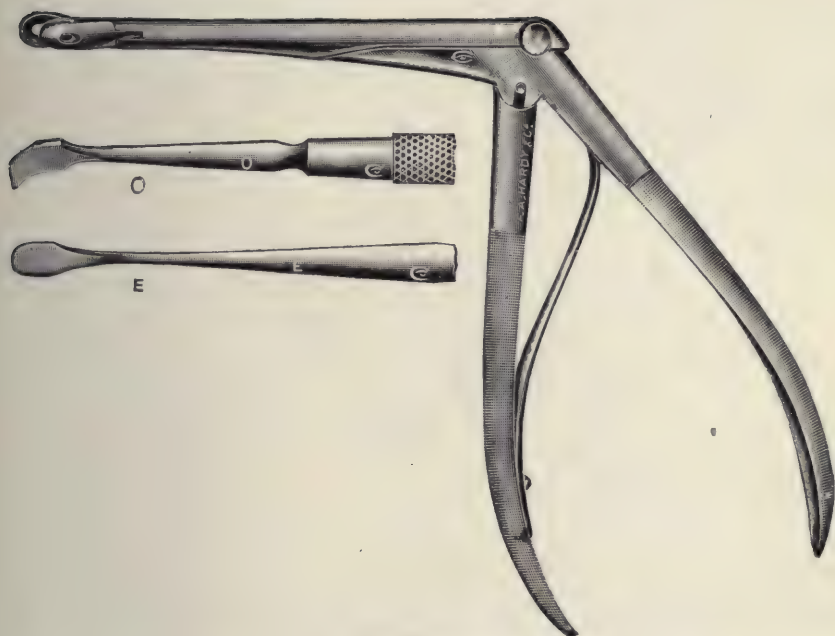


FIGURE 8.

E, Roundbladed knife, for splitting periosteum along top of ridge; O, Raspatory, for denuding ridge; reinforced Freer-Gruenwald forceps.





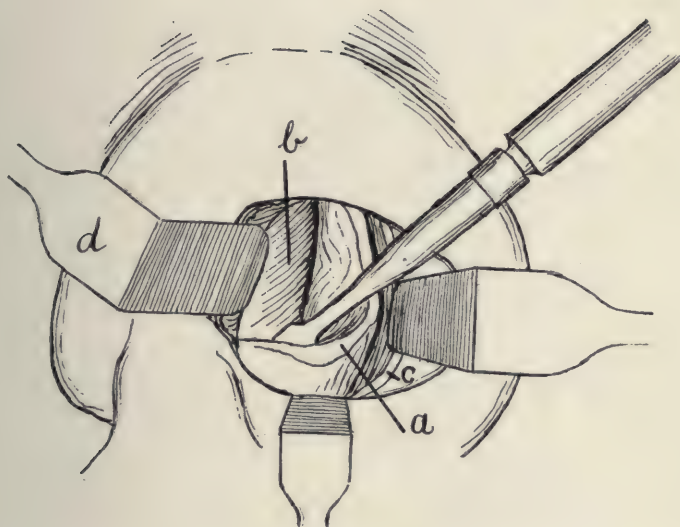


FIGURE 9.

The left nostril held open with retractors; the entire bony deflection including the ridge, a, has been bared of its covering by the raspator, which may be seen working towards the nasal floor on the concave side of the deflection; b, Mucous membrane of the opposite nostril uncovered by the removal of the cartilage and uplifted from the bony deflection; c, Cut edge of the uplifted covering of the posterior part of the deflection held away with a long retractor; d, Retractor holding forward the anterior (reversed L) flap.



## XXXVI.

### SOME LABORATORY AIDS TO OTOLOGIC DIAGNOSIS.\*

By FREDERICK E. SONDERN, M. D.,

NEW YORK.

The usefulness of the differential leucocyte count as an aid in the diagnosis of inflammatory lesions, the added significance it gives to the leucocyte count itself and the value of the ratio existing between the two, as originally described in the *Medical Record*, March 25, 1895, have been accepted as important aids by the physician as well as the surgeon, to which the many articles in current medical literature bear testimony. Their application in acute middle ear disease and its complications was the subject of my communication read before the Otological Section of the New York Academy of Medicine three years ago (*Archives of Otolaryngology*, 36, 1), and continued contact with cases in which this diagnostic and prognostic aid is sought has strengthened my belief in its value. It is obviously difficult for the laboratory worker to present substantiating clinical reports, nor is this necessary at present, owing to the large number which have been published by surgeons of both continents. When dissatisfaction with the method has been expressed it can usually be traced to a disregard of the limitations and exceptions from which no laboratory procedure is immune. Accurate technic is absolutely necessary, and while simple, is not universally practiced by any means. Inflammatory lesions confined to cellular bone structures do not show as high leucocytosis or relative polynucleosis as noted when soft parts are involved, but the disproportion between the two is present, as shown by the resistance line, in the majority of cases, and, after all, this constitutes the important feature. The claim that pus was found with slight polynucleosis and

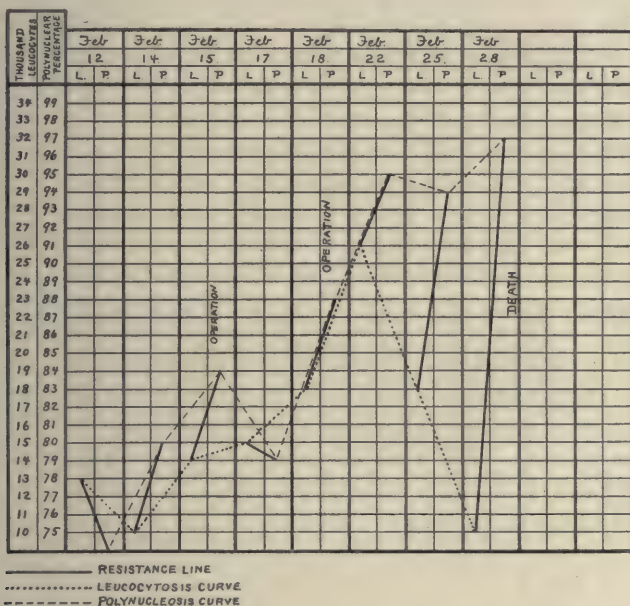
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\*Read at meeting of American Laryngological, Rhinological and Otological Society, Washington, April, 1910.

none with marked polynucleosis, or that the leucocyte count was low in severe cases and high in slight ones, demonstrates that the most valuable feature of the method has been overlooked, namely, the relation between leucocytosis and polynucleosis, or the resistance line. It has also been stated on several occasions that lesions confined to bone show no blood change. This is contrary to the experience of most observers. As previously stated, purulent inflammations in cellular bone structures, as a rule, show lower figures than processes of similar severity in soft parts, though not necessarily so. Suppurative processes on the surface of mucous membranes, pyogenic infections mixed with tuberculosis, typhoid fever or measles, or following these diseases show relatively low figures. When purulent exudates are confined in dense pyogenic membrane and toxic absorption is prevented, or when they are the result of organisms which do not produce leucocytosis or relative polynucleosis, the absence of these changes is explained. The exact bacterial nature of the infection also has a bearing on the degree of leucocytosis and relative polynucleosis. With the exercise of every precaution, a relatively very small number of cases is met with in which the examination does not reflect the true condition. These are usually patients with much reduced vitality, and it seems reasonable to look to one of two causes for an explanation. Either the vitality is so low that absorption of toxin no longer takes place or on account of improper circulation the drop of blood taken from the finger or ear does not represent the actual condition of the blood as a whole. It is probable that the same reason explains why the method does not work out as well in infants and young children, particularly in those in whom the prostration is extreme. After the leucocyte count and polynuclear percentage have been determined the resistance line should be drawn, as shown on the accompanying chart, which is an improvement suggested by Wilson of Rochester, Minn. (*Northwestern Lancet*, July 1, 1901), on the chart as originally proposed by Gibson, by showing successive examinations as in a temperature chart instead of on top of one another. It goes without saying that repeated examinations are essential if the desired information is to be obtained. A horizontal or falling resistance line means good leucocytosis and relatively moderate polynucleosis, the higher in the scale the greater the



severity, but in any event well borne by the patient with comparatively good prognosis. An ascending resistance line means insufficient leucocytosis and relatively pronounced polynucleosis, the longer the line and the higher in the scale the greater the severity, the poorer the resistance and the poorer the prognosis. The dotted line shows the leucocyte curve, while the dashed line shows the polynuclear percentage curve. A brief description of the case plotted, a mastoiditis followed by sinus thrombosis and general sepsis, will illustrate the usefulness



of the chart. The first examination shows 13,000 leucocytes and 74% polynuclear cells, or a descending resistance line low in the scale, indicating mild infection and good resistance. Second examination: 13,000 leucocytes and 80% polynuclear cells, or an ascending resistance line higher in the scale. Neither the leucocyte count nor the polynuclear percentage is high, but the resistance line indicates more marked infection and loss of resistance, which, in view of the clinical history, justifies the suspicion of the presence of a purulent exudate. Third examination shows the same, somewhat higher in the scale. Fourth examination shows some improvement. All

subsequent examinations show increasing infection and decreasing resistance to the end. Drawing the resistance line on a chart as illustrated is to be recommended when blood examinations are made as a routine procedure, as it enhances the value of the determinations.

Iodophilia as an indicator of the presence and severity of an inflammatory process was warmly recommended by Locke (*Boston Medical and Surgical Journal*, 1902) some eight years ago, and while the method still has a few advocates it has been abandoned by the majority in favor of the leucocyte and differential count ratio.

The Arneth nuclear count has as its object the determination of the phagocytic power of the blood, on the basis that the older polynuclear cells are the true phagocytes. In a recent article by Dluski and Rospedzihowski (*Beitr. z. Klinik d. Tuberk.*, XLV. No. 3), this is modified by the statement that the older polynuclear cells are the antitoxin bearers or producers. The degree to which these older cells are destroyed by the action of the infection is believed to be characteristic of the severity of the affection and of the resisting power of the patient. Several years ago I had a long series of observations tabulated (Smith and Lansing, *Bull. Lying-In Hosp.*, March, 1908), which failed to bear out this claim. Milligan read a paper before the Otological Section of the New York Academy of Medicine some time ago, which I have not been able to find in print, in which he advocates the use of the method, particularly in infants, to get an index of the resistance as well as of the severity of the infection. Though faithfully tried, I regret that I was not able to demonstrate the value of the method for this purpose.

The introduction of comparatively simple apparatus for sufficiently accurate determination of the viscosity of the blood by Hess and others promises an additional clinical laboratory help in diagnosis. W. Müller (*Centralbl. f. Chir.*, Oct. 9, 1909) recites the results of his investigations in surgical affections. The viscosity normally increases during the first day after operation. It then declines to normal in three days, is subnormal for two days and then returns to the normal. It is abnormally high in acute inflammatory lesions, and sudden decline indicates exhaustion. Any focus of inflammation causes increased viscosity of the blood and rapid and regular

postoperative decline indicates freedom from complications. Rubino (*Policlinico*, Aug. 29, 1909) claims that the change in viscosity of the blood is one of the first signs of cardiac insufficiency. A far greater amount of investigation will be necessary before the method can become of practical use to the clinician.

The examination of aural discharges should include a bacteriologic and cytologic investigation. While it is not within my province to urge the clinical necessity for this information, there is no doubt that this laboratory factor is a valuable adjunct to diagnosis and prognosis, as the published records of Suepfle, Witmaack, Libman and numerous others quoted by the latter indicate. The bacterial examination can be made in two ways, by means of stained smears of the discharge and by culture on suitable media. The examination of properly prepared stained smears is of considerable diagnostic value, but there is not only occasional difficulty in determining the identity of the organism found solely on its morphologic features and staining quality, but these may at times be directly misleading.

The differential staining methods as proposed by Buerger (*Journ. Infect. Dis.*, June, 1907) are certainly a great help, but they unfortunately make it necessary for the microscopist to be present when the specimen is obtained, if the method is to be applied directly to the aural discharge, a difficulty more easily overcome in hospital than in private practice. Rulison (*Journ. A. M. A.*, April 30, 1910) has just described a much more simple method of staining capsules, which promises equally good results. The use of these methods will demonstrate how crude the ordinary procedures usually employed are, and in consequence the results of the latter must be taken for what they are worth. Some workers go so far as to refuse to interpret information from any single smear, though this would seem ultra-conservative. Cultures from aural discharge certainly allow a more accurate determination of the bacterial content, provided the medium be properly selected and the organism grows on it. As there are a number of organisms found in aural discharge which it is difficult or impossible to demonstrate quickly on culture, such as tubercle bacilli, gonococci, Vincent's spirillum and others, it is advisable to use both methods. Direct staining for immediate infor-



mation and culture for corroboration and to have material for vaccine if this therapy should be decided on. A very complete enumeration of the organisms met with, particularly in cases of chronic otitis media, can be found in an article by Wingrave in the *Medical Press* of London, 1908.

The cytologic study of aural discharges has had comparatively little attention, if journal articles are a proper indication. As applied to transudates and exudates other than those from the ear, it has proved to be of value in diagnosis, and therefore an investigation of the subject is justified, particularly in chronic discharge. Wingrave in the article quoted also calls attention to the benefit derived from cytologic studies. Several years ago I made cyto counts in quite a number of specimens of aural discharge received for examination, with the hope that an interest might be created. The number is not sufficient to justify conclusions, but in a general way it may be said that an acute otitis media shows a pronounced predominance of polynuclear cells. In the cases which promptly get well the count soon changes to about equal percentages of lymphocytes and polynuclear cells, while the cases which do not do so well, and particularly those in which mastoid involvement follows, continue to show a high polynuclear percentage for some time. The nature of the organism also has an influence on the figures. The smears used to determine the organism can also be used for obtaining the cyto count.

The blood culture is of particular diagnostic value in the complication of otitis media, owing to the frequency and significance of bacteremia. The researches of Libman (*Amer. Journ. Med. Sciences*, September, 1909), in the otologic service of Gruening at the Mt. Sinai Hospital, are particularly praiseworthy on account of the accurate technic employed, not only in the culture, but also in the identification of the organisms obtained. A critical study of the opinions voiced by different observers as well as personal experience in reference to the invariable absence of a bacteremia in cases of otitis media with mastoid involvement and without sinus thrombosis, would indicate that this is still an open question and by no means settled, as Libman would have us believe. Cases are now and again met with in which a bacteremia is demonstrated, not only in one, but in several cultures, and where there



are no evidences of sinus thrombosis, though these are certainly exceptional instances. It is beyond the scope of this communication to enter into a consideration of the value of both negative and positive findings, nor can those tabulated by Libman in his last paper on the subject be improved upon.

Vaccine therapy rests, according to Wright, on the basis that the opsonic value of the blood is reduced and can be brought to normal or above by the injection of the bacterial vaccine. This stimulates the formation of antibody only if the cells are in condition to react. In active systemic infections the opsonic value of the blood is high and does not need increasing, and the cells are exhausted and consequently cannot be stimulated to produce more antibody. It is on this ground that the use of vaccines is not advised in acute systemic infections; if, however, they are found useful in these cases, it will be necessary to modify the views concerning their mode of action. If the present theory is correct, an ascending resistance line found on blood examination, and particularly the demonstration of a bacteremia, should contraindicate the use of vaccines. Personal experience, as well as the opinions of Thomas (*Journ. A. M. A.*, Oct. 12, 1907), Potter (*Journ. A. M. A.*, 49, 1815), Saathoff (*Münch. med. Woch.*, 55, 779) and many others indicate that the opsonic index determination is inconstant and impracticable and not to be recommended as a diagnostic procedure. Horder's description of the reasons for this in the *St. Bartholomew's Hosp. Journal* is interesting.

The information obtained from the urine concerning evidences indicating the presence of nephritis or diabetes, as well as intestinal toxemia, acidosis or other forms of faulty metabolism, is of interest to the otologist, as it has a bearing sometimes on the diagnosis and more often on the prognosis of the ear lesion. Careful analysis of the urine prior to anesthesia is frequently a safeguard against disagreeable surprises afterward.

In closing, allow me to say that the most ardent advocates of laboratory aids, if they have clinical experience, have never intentionally conveyed the idea that these methods are intended to take the place of clinical observation. The most acute bedside observer is usually the one who also obtains most help from laboratory procedures, as he is well versed in the value of this information. When interpreting the significance of

laboratory findings, no matter how characteristic these may seem, it is imperative to recall all the causes which may occasion this change, and disregard of a single one is the most potent factor in erroneous conclusions. Laboratory methods of diagnosis are aids only, and are not intended to replace diagnostic skill or prognostic ability based on clinical experience

XXXVII.

QUININÆ AND UREA HYDROCHLORATE  
(SYN. QUININÆ-CARBAMIDUM, UREA-  
QUININE) AS A LOCAL ANESTHETIC.\*

By E. FLETCHER INGALS, M. D.,

CHICAGO.

In the *Journal of the American Medical Association*, October 23, 1909, there appeared a short article by Drs. A. E. Hertzler, R. B. Brewster and F. B. Rogers on the use of quinine and urea hydrochlorate as a local anesthetic. They referred to an article by Dr. Thiebault, 1907, who recommended a 1% solution for local injection and from 10 to 20% for local application to the mucous membranes. They also referred to an article by E. J. Brown, *Journal American Medical Association*, August, 1908. He recommended this drug in tonsillectomy and adenectomy. Thiebault found that after the injection of a 1% solution perfect anesthesia was obtained that lasted four or five hours. The authors of the more recent article, as a result of their clinical and experimental use of this drug, confirmed the former reports, and Hertzler claims that after injection of  $\frac{1}{2}$  to 1% solutions immediate and perfect anesthesia occurs and lasts for four or five days, and that complete restoration of sensation may be delayed for from ten to fourteen days. They found this drug an efficient and safe local anesthetic when injected in solutions of from  $\frac{1}{4}$  to 1% in water; but the 1% solution caused undue fibrinous exudation with induration that appeared to interfere with primary union in some instances; yet, in other cases this was an advantage by tending to check hemorrhage. They suggest a solution of from 10 to 20% in strength as an anesthetic when applied to the surface of the mucous membrane. One hundred grains of this drug were injected into the veins by Brewster in the

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\*Presented to the American Laryngological Association, Washington, May, 1910.

course of six hours, in a case of pernicious malaria, with recovery of the patient.

For a long time I have been searching for an agent that would produce prolonged anesthesia of the mucous membranes, for the relief of hay fever and hyperesthetic rhinitis, therefore I grasped eagerly at this and began at once using it in my ordinary operative procedures in the nose; but owing to the season of the year, I had no opportunity to try it carefully in either of these extremely sensitive conditions. At first I tried a 20% solution of the quininae and urea hydrochlorate in water as a local anesthetic for the nasal mucous membrane. I found that this solution was too concentrated for satisfactory use, as it crystallized when the water became cool; but it produced complete anesthesia, though it required about four times as long to obtain this result as with the 20% solution of cocain in 1 to 1000 of suprarenalin. At first, after the anesthesia had been obtained, I applied the suprarenalin solution 1 to 1000 to prevent bleeding, but the results were not satisfactory. I did not use the two together, fearing that the suprarenalin would interfere with absorption of the anesthetic. I then tried combining the quininae-urea hydrochlorate in solution with the suprarenalin and found that although slow in action it caused perfect anesthesia and prevented bleeding. Desiring more rapid action, I next combined 15% of the urea-quinine with 5% of cocain hydrochlorate in a solution of 1 to 2000 of suprarenalin. This produced anesthesia as quickly and sometimes apparently more quickly than a 20% solution of cocain in 1 to 1000 of suprarenalin, and the anesthesia was more prolonged. However, I have not been able to determine the duration of the anesthesia. This solution turns to a brownish color after a few hours, but it seems to work about as well as when first made up, excepting that the activity of the suprarenalin appears to be somewhat diminished. It would probably be better to combine the solutions just as they are to be used, but the other plan works so well that I have continued to use it to avoid the trouble of preparing the solution each time.

From my experience in many cases of deep cauterization of the turbinated bodies in which I have used this anesthetic on the mucous membrane, I have the impression that considerable anesthesia lasts for hours, but I have not obtained such



prolonged anesthesia as reported by Hertzler, who used it hypodermically.

In the treatment of intumescent or hypertrophic rhinitis, I have used this anesthetic many times before making long, deep linear cauterizations across the inferior turbinated body, and have had profound anesthesia in every case. After cauterizations of this sort, where cocain or cocain and suprarenalin have been used as an anesthetic, the reaction is generally so great that when the patient returns at the end of four days after the cauterization the affected naris is much obstructed by a mass of inflammatory lymph about 4 c. m. long, about  $1\frac{1}{2}$  c. m. wide and from 2 to 4 m. m. in thickness. This renders it necessary to pass a probe between the turbinated body and the septum to prevent adhesions; but after using this new anesthetic with the same sort of cauterization there has been much less reaction, and we have seldom seen more than from 25 to 50 per cent as much of this inflammatory lymph. This fact seems to indicate that the new anesthetic minimizes the reaction.

I have used this same solution in the larynx, trachea and bronchi in connection with ether anesthesia, in six bronchoscopies in children, for the removal of foreign bodies from the lungs, without any unpleasant results, and I have not hesitated to use it freely. In one of these patients, fearing the necessity of a tracheotomy, I first anesthetized the region over the trachea with a few drops of the same solution diluted 30 times with distilled water, but as tracheotomy did not become necessary I could not judge accurately of the extent of the anesthesia; however, the hypodermic use of the anesthetic did not affect the little patient unpleasantly.

I have used the same solution, diluted about 15 times, submucously in connection with topical applications in the nares in three or four cases. In one of these, where a painful operation on the posterior ethmoid cells was done, it gave excellent results, and in the others the anesthesia appeared to be more complete than could be obtained by applications to the surface alone.

I have used this anesthetic for turbinectomies, for the removal of polypi and in several operations for removal of spurs or ridges from the septum or for submucous resection, with great satisfaction. In all of these cases it appears to me to

have acted much better than a 20% solution of cocain in 1 to 1000 of suprarenalin solution.

In one instance, where I used it submucously to relieve nasal neuralgia, the patient suffered for several hours afterward from pain, and from her report there appeared to have been much swelling of the nasal mucous membrane. I had one patient with hyperesthetic rhinitis, to whom I gave a 10% solution of quinine and urea hydrochlorate,<sup>1</sup> but she complained that it smarted so badly that she was unable to use it; but I have tried it in fairly healthy nares in solution in distilled water, and in Dobell's solution, and found that a 10% solution could be borne by very sensitive persons and a 15% solution in ordinary cases.

I have tried this drug in the nares triturated thoroughly with sugar of milk up to a strength of 5%, which appeared as much as could be easily borne by the ordinary person; 4% seemed as strong as could be used comfortably by those with very sensitive mucous membranes.<sup>2</sup>

This is a very valuable local anesthetic; but my experience does not lead me to anticipate very much benefit from its use in either hyperesthetic rhinitis or hay fever. However, in view of the claims that have been made for it in producing prolonged anesthesia, and in view of the old treatment of hay fever by nasal applications of a solution of quinine, I think it well worth while to give it a fair trial in these affections.

34 Washington Street.

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1. My subsequent experience leads me to believe that there was no ground for this complaint.

2. I have since used ten per cent of this drug in powdered sugar of milk in persons with very sensitive nares, without any inconvenience, and I would advise trying this strength in hay fever.

XXXVIII.

THE MANIFESTATIONS OF RECURRENT INFLUENZA IN THE NOSE AND THROAT.

BY JOSEPH L. GOODALE, M. D.,

BOSTON.

The object of the following paper is to call your attention to a class of cases characterized by annual recurrence of influenza or influenza-like attacks, which exhibit certain definite clinical phenomena.

At the outset it should be said that the term influenza is necessarily used with a certain latitude. F. T. Lord<sup>1</sup> reports an epidemic of influenza taking place in Boston in 1907 and 1908, from which he comes to the conclusion that until the etiology of the disease is finally determined it seems best to continue the use of the term influenza to designate a complex of symptoms without regard to the apparent bacterial cause. The same writer<sup>2</sup> studied the bacteriologic findings occurring in interepidemic cases, finding the influenza bacillus in practically pure culture in 25% of the cases, and the same organism mixed with other bacteria in 59%. He concludes that the etiologic unit appears to be lacking in the epidemic cases, not only as regards the influenza bacillus, but also for other organisms, since no one group of bacteria could be demonstrated as a constant invader in the specimens. In the absence of other discoverable causes, he comes to the conclusion that various organisms, as influenza bacillus, the pneumococcus, the micrococcus catarrhalis, the pyogenic cocci, and others, singly or combined, are responsible not only for the interepidemic, but also for these epidemic cases with the clinical picture of influenza.

In an examination of cases by William H. Park,<sup>3</sup> in 1905, of an epidemic in New York City, it was shown that pneumococci and streptococci were usually present, in association with influenza bacilli. These occurred in normal individuals, as

well as those suffering from colds, grippe and bronchitis. It seemed reasonable to assume that with an inflammation of the mucous membrane, these microorganisms increase in number and virulence. Park came to the conclusion that under ordinary circumstances, a variety of microorganisms exist, which, under ordinary circumstances, are innocuous, but which become virulent when the natural resistance of the tissues is lowered by a cold. It is also probable that the same microorganism may exhibit an increase of virulence during an infection, and that the same bacterium when transported to another throat is then better prepared to excite the disease than the organisms already existing in the individual. During an epidemic the virulence is so increased by frequent transplantations that in a certain number of individuals the simple deposition of the bacterium upon the mucous membrane is able to excite the disease. He comes to the conclusion that the bacteriologic examination in these cases is more of scientific than of practical interest.

In routine work, therefore, where bacteriologic examinations are not made, we may be justified in making our diagnosis of influenza by the clinical phenomena. These enable us to say with a fair degree of accuracy how far the bacilli of influenza may be an etiologic factor in the production of the symptoms-complex. Among the multifarious types of acute inflammation of the upper air passages, certain salient features are conspicuously characteristic of the different pathogenic microorganisms. Thus, with the staphylococcus pyogenes, we expect pus formation; with the streptococcus, a more intense inflammation and production of fibrin; with the pneumococcus and the diphtheria bacillus, a fibrin formation, each microorganism having also a more or less well-marked clinical picture. In the differentiation of these affections, the following arrangement is helpful from the standpoint of etiology: First, I am accustomed to exclude influenza in those acute inflammations of the upper air passages, invading primarily the columnar, ciliated mucous membrane of the nose, larynx and trachea, in which the element of trauma plays a considerable part. We may thus find conditions to arise from exposure to dust, irritating vapors and excessive use of the voice, also from exposure of the throat to cold winds, to which it has not been previously accustomed, as in the case of an



individual, normally a nose-breather, suddenly obliged to breathe through the mouth, and to face a cold wind, laden with dust. Under such circumstances, an attack of primary laryngitis or tracheitis is to be expected. Within the last few years, this type of case, since the advent of motoring, has become especially frequent. To my mind, these cases are primarily traumatic and only secondarily infectious inflammations, and are to be treated locally from this point of view, the object being chiefly to provide rest for the part and a protective covering.

Second, I exclude influenza in conditions where the inflammation originates in the lymphoid tissue of the fauces and completes its history in these situations. These conditions are primarily infectious rather than traumatic, and comprise the various forms of acute inflammation of the faucial, pharyngeal and lingual tonsils. In these cases the inflammation does not extend to the neighboring regions beyond a slight degree. The pathogenic microorganisms are chiefly the streptococcus, staphylococcus and pneumococcus. (Diphtheria is omitted from consideration.)

The influenza group of inflammations of the upper air passages is characterized in its typical form by the following phenomena: Pathologically the ordinary inflammatory alterations are seen to be marked by a predominance of epithelial desquamation and by submucous edema. Clinically we find sudden onset, fever, prostration, accompanied or followed by marked depression of spirits.

Such is the picture usually presented by the individual experiencing his first attack of influenza. With the recurrence of the inflammation in successive years, however, a certain relative tolerance to the toxin appears to be acquired by the system. We find, under these circumstances, the same sudden onset, but symptoms throughout of less intensity, at times difficult to distinguish from ordinary traumatic colds. A distinguishing feature is, however, the remarkable persistence of purulent discharge from the affected regions, whether sinuses, trachea or bronchi, their slow tendency to recovery, and the elevations of temperature excited by physical exertion.

In the past few years my attention has been especially attracted by a group of cases exhibiting a well-defined symptom-complex, and it is to this that I wish to call your attention.

Briefly, these cases are characterized by a primary involvement of lymphoid tissue in the pharynx or nasopharynx, and an immediate extension of the inflammatory phenomena to the mucous membrane of the sinuses, trachea and bronchi, with simultaneous subsidence of the inflammation in the lymphoid tissue. Examining these patients now in more detail, we find a past history of annual attacks of inflammation, the earlier ones intense and prostrating, but becoming progressively milder. In the present illness, examination of the throat at the onset shows reddening and swelling of one or more pharyngeal granules or of the tonsils, accompanied by moderate pain or at times only a slight burning sensation on swallowing. It is important to note that this involvement of the lymphoid tissue precedes any disturbance of the nose or lower air passages. It is always transitory, but its disappearance is immediately followed by inflammation of the sinuses and of the trachea or bronchial tubes. A characteristic occurrence is acute inflammation of the ethmoid sinuses on one side, and of a definite region in the bronchi, on the corresponding side. Purulent discharge appears in the nose, and simultaneously cough with purulent expectoration. In these cases I have found the ethmoid more frequently affected than any other sinus. It is to be noted that if deviation of the ethmoid plate of the septum exists, it is the middle turbinate region opposite the concavity which is more frequently involved than its fellow on the opposite side. Examination of the chest shows a bronchitis limited to a small, well-defined region. At times physical signs in the chest may be wanting, but the patient complains of a sensation of pain or lameness on one side. These conditions last for several weeks. The cough is severe and out of proportion to the amount of expectoration. There is manifestly a nervous element in its causation. It is often referred to a particular spot in the pharynx, which shifts its seat from day to day, moving from one pharyngeal granule to another.

While sometimes considerable loss of strength, color and flesh accompany these manifestations, yet often the patient shows only a moderate depreciation of vitality, being troubled chiefly by the profuse purulent discharge from the sinuses and bronchi. As these symptoms usually last for several weeks, the question of tuberculosis is apt to be raised in the mind, both

of the patient and his physician. In addition to the absence of tubercle bacilli in the sputum, the most reassuring element is the history of previous similar attacks. It is, in fact, so regular an affection that patients at the very onset of a pharyngeal pain have predicted to me with accuracy the subsequent course of the disease.

In view of the regular involvement of a given sinus and of a definite bronchial area, the question suggests itself, What is the pathologic condition existing between attacks in these regions which predisposes them to invasion? In the nose, this query is perhaps sufficiently answered by the demonstration of chronic hypertrophy or actual polypoid degeneration of the mucous membrane of the affected middle turbinate. In the bronchi, we have, so far as I know, no direct evidence from postmortem findings. Whether a condition of bronchiectasis or hypertrophy of the bronchial mucous membrane exists, either singly or in association, remains to be determined. It would seem probable, however, that a condition is present in a well-defined bronchial area analogous to that which can be observed in the ethmoid sinuses.

With regard to treatment, I may first say that out of twenty cases observed in the past few years I do not remember to have been able to abort the attack in a single instance. When once the lymphoid elements in the pharynx have become inflamed the local application of guaiacum or of the silver salts have only doubtfully shortened the pharyngeal symptoms, but the sinus and bronchial inflammation has succeeded with regularity and apparently uninfluenced. The measures of chief importance have seemed to me to be a change of air during the attack and an obliteration, as far as possible, of the lymphoid elements in the pharynx during the intervals.

With reference to a change of air in these cases, it has seemed to me, in the early stage, while the symptoms are increasing in intensity, that transition to a colder, drier and higher region was more productive of harm than good. The symptoms appeared, under these circumstances, to be increased in intensity, the cough was made worse and the fever prolonged. I have come, therefore, to regard perfect rest at home as the best plan to pursue in the first half of the affection. After the inflammation has passed the acute stage and the fever has subsided, it has seemed to me that a change in



the winter months to a warm, moist atmosphere gave little improvement. Such places are Charleston and the whole coast from South Carolina to Palm Beach. The air in these regions during the winter is laden with moisture, and patients have expressed themselves to me after their return as having experienced little or no improvement. On the other hand, the interior of Florida, the sandy regions in South Carolina and Georgia, away from the coast, during the winter months, often manifest a prompt influence upon the nasal and bronchial secretion. A stay of at least two weeks is necessary before the patient can be safely trusted to return home. I have frequently observed, where the time has been limited and the patient obliged to return North after a short stay on the Florida east coast, with perhaps no improvement in the amount of nasal discharge and expectoration, that the return under these circumstances to the more stimulating Northern air, is followed by immediate improvement. Patients may be sent North, however, during the winter if the acute symptoms have entirely subsided, and if time is limited, are more likely under these circumstances to experience benefit than if they attempted to go to a warmer climate.

The matter of change of climate may thus be briefly summarized: In the early stage of this type of influenza of the nose and throat entire rest at home is to be advised. With the subsidence of the febrile symptoms, if time permits, a change to the South, away from the seacoast, is to be recommended, but if a patient has a week or less at his disposal he may be recommended to go to a higher, drier region farther North.

With reference to treatment of the persistent cough, after the subsidence of the acute stage, I have found little benefit from sedatives, but a marked improvement to occur from superficial cauterization of the granules in the pharynx. The patient is often able to point with exactness to a single granule as the source of the uncontrollable tickling, and this may be touched with crude carbolic acid with immediate relief. It often happens, however, that on the following day a granule in the vicinity, or on the other side, is complained of and requires cauterization. The carbolic acid should be applied carefully to the granule and not to the mucous membrane in the vicinity.

A consideration of these cases renders it probable that the



infecting agent enters the mucous membranes through the lymphoid tissue of the pharyngeal follicles, or of the tonsils, or of the adenoid, and the preventive treatment of this condition has therefore suggested itself to me. On theoretical grounds we should expect, if the mucous membrane of the pharynx were deprived of its crater-like granules and the tonsils made more resistant, that the individual would be able to receive with greater impunity in the mouth the successive volleys of virulent microorganisms, which he continually has to face during the winter. If it be true, as suggested by Park, that our attacks of influenza are due to the progressive heightening of the virulence of the organism with each transfer, it would seem reasonable to assume that many attacks may be escaped if the individual does not possess loopholes in his most exposed regions, through which the organisms may penetrate. I have, therefore, been carrying out systematically, during the past few years, the obliteration of the pharyngeal follicles, so far as practicable, by strong solutions of silver nitrate. At the same time I have introduced solutions of silver nitrate into the tonsillar crypts where possible or brushed this reagent over the surface of the tonsil. Where the individual has complained of his nasopharynx as being the primary source of the infection, special attention is given to this region by painting its surface with a weaker solution of the silve nitrate.

The claim of preventing a disease by treatment is not willingly made by any of us, where our etiologic and pathologic knowledge is as meager as in the present subject. Yet since we are struggling to advance our control over disease, it seems to me that we should not be deterred from presenting to the consideration of our fellows any ideas, however insufficiently established, which have been helpful to ourselves or which carry a promise of assistance to our patients.

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## XXXIX.

### LARYNGITIS DOLOROSA.

BY WOLFF FREUDENTHAL, M. D.,

NEW YORK.

The title adopted for this paper is not intended to indicate that a new disease is to be discussed, but is rather to be taken as a symptomatic designation for many affections that may well be grouped under the same head.

Since Guyon applied the term of cystitis dolorosa to a variety of bladder troubles, such as ulcers, neoplasms, stones, etc., all of which have the one symptom in common, viz.: attacks of severe pain, it seemed to me proper to give the name laryngitis dolorosa to all those affections of the larynx in which pain is the most prominent feature. As that symptom is of so great importance, not only with reference to the comfort, but also the life of the patient, and as its treatment can be considered from one common viewpoint, the writer has taken the liberty of bringing this theme before this body of experienced men, hoping thus to contribute to some extent to the management of some of the most obstinate cases met with in practice. Diverse as is the general treatment of such diseases as lues, tuberculosis, etc., the symptomatic therapy of the larynx in all these cases will be very much the same.

Since pain is the only symptom which we are considering, and this occurs most often and severely in ulcerative processes of the larynx, we shall confine our remarks to

- (a) Tuberculous ulcers;
- (b) Syphilitic ulcers;
- (c) Carcinomatous ulcers;
- (d) Diabetic ulcers.

It may be said that since the writer in 1899 described the occurrence of diabetic ulcerations in the larynx,<sup>1</sup> little has been published on this subject. Certainly such cases are rare; but

when they do occur and are recognized, their treatment is very gratifying. But although ulcerations of the larynx, whatever their origin, may be treated on similar lines, locally, in order to relieve the pain, yet there seems to be a difference in regard to certain applications, of which we shall speak later.

The local treatment of these cases should be divided into two forms—the intralaryngeal and the extralaryngeal.

Whatever treatment be adopted in the disease, which will occupy most of our time, viz., tuberculosis, three requirements have to be fulfilled: (1) To stop the cough, which originates in or near the larynx; (2) to remove the dysphagia; and (3) to seek to effect a cure by local applications.

If one sees a patient with infiltrations in the larynx there is little to be done—in fact, it is best not to resort to any treatment whatsoever. About a year ago Sir Felix Semon published an article in the *Berliner klinische Wochenschrift*, recommending laryngeal rest as the main factor in the management of such cases. Long before that time the writer had advocated such a procedure, and had sent many patients to the West and Southwest of the United States, where an enforced rest of the larynx was secured. These patients were not able to talk for days and weeks at a time, for the simple reason that they had no one with whom to converse. At the Bedford Station Sanatorium a similar mode of treatment is followed; that is, the patients are ordered to keep silent, to avoid irritants, such as smoke, dust, tobacco, etc., and a number of them recover.

If, however, these infiltrations break down and ulcers appear, then the pain often sets in, and the method of treatment is much more difficult. For years we have applied lactic acid in these cases. Working under Krause when he first tried it, the writer was the next to make use of it, and did so for at least fifteen years, simply for want of something better. It has now been discarded entirely by me, and the only time it may be effectively used is after a thorough curettage.

A new astringent has lately been introduced, under the name of omorol (Heyden). This is an albuminate of silver which appears to have a distinct penetrating action. It is not soluble in water and must be employed as a powder. In some cases it seems to be very efficacious. The writer has used it in some ulcerations of the larynx with quite satisfactory results.

If a deeper caustic effect is desired, it is best to use the galvanocautery point, as proposed by my friend, Ludwig Grünwald, of Munich. Siebenmann, of Basel, also advises treatment with the galvanocautery, having tried it in 66 cases. The writer employs the galvanocautery occasionally, and is inclined to recommend it for certain cases, but at the same time would caution against severe cauterizing at one sitting. It has been claimed that edema of the larynx does not follow this treatment. This, however, occurred in one of my cases. The patient, a rather strong man, desired to get through as quickly as possible, and was cauterized quite extensively in the larynx. The following night he developed a very unpleasant edema, which, fortunately, subsided the next day, the patient feeling much improved. Perhaps the writer himself was responsible for this accident, which might have been avoided by more conservative treatment.

A more important point than the application of caustics is to remove the hyperalgesia of the larynx by drugs, thus enabling the patients to take solid as well as fluid foods. In former years there was nothing at our disposal with which to accomplish this except cocain. I hope no one at the present time will resort to it, since we have better drugs for this purpose.

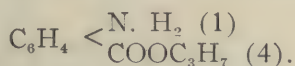
The first of the new preparations for producing prolonged analgesia was orthoform. What has been reported by me about orthoform on many occasions holds good to-day. It is an excellent analgesic drug, if you can reach the ulcerated parts with it. Perhaps some have used the emulsion which bears the writer's name. But orthoform has its disadvantages. If applied to the skin, it often produces a very unpleasant dermatitis. The writer had a case in his own family in which a salve containing orthoform had, without his knowledge, been applied to the skin, the patient developing a dermatitis over the entire body.

The drug next to be recommended was anesthesin. It proved indeed a very valuable addition to our pharmacopeia, and the writer used it frequently. But a case of poisoning resulted after administration of a 3-grain powder of this drug. The experiment was twice repeated with one-half the dose, and each time the patient developed cyanosis of the lips, face, fingers, etc. Whether in this instance it was a mere idiosyncrasy it is impossible to say, but it made me cautious.



Finally Dr. Stürmer and Dr. Lüders, of Hamburg, published in the *Deut. Med. Woch.*, No. 53, 1908, their experiments with another drug, which they called propæsin. They had started out to discover a product that would have all the good qualities of anesthesin and orthoform in a higher degree, without any of their deleterious effects. Apparently they found it in propæsin, which is nontoxic (two grammes have been taken per os without bad results) and produces a much more prolonged analgesic effect than that of either of the others. Thus they found that the powder applied to the conjunctiva of a guinea pig caused an insensibility of the cornea, lasting with orthoform 9 minutes, with anesthesin 21 minutes, and with propæsin 84 minutes.

Chemically orthoform is methylester of metamido-paraoxybenzoic acid; anesthesin is ethylester of paramido-benzoic acid; propæsin is propylester of paramido-benzoic acid. Chemically propæsin is=



It is a white crystalline powder, almost tasteless and odorless, soluble in alcohol, ether, etc., but not in water. I use the powder or an emulsion that I have had made. The latter consists of

Propæsin .....	5.0
Formaldehyde .....	1.0
Menthol .....	0.5
Ol. amygdal. dulc.....	15.0
Gum. acaciæ qu. s.....	.....
Aqu. dest. ad.....	50.0

I must repeat: What I formerly have said of orthoform and anesthesin holds good to-day. They were great improvements in our armentarium medicorum, but, according to my present knowledge, propæsin is better.

I shall omit any histories, since you will try that drug yourselves.

The same treatment was followed in two cases of syphilitic ulcers of the larynx with good results.

Of late dionin has been applied directly to laryngeal ulcerations, it is claimed with good results, but the writer has had no experience with this drug.

## INJECTIONS OF ALCOHOL.

There are many cases in which we cannot reach the diseased part, as for example, in a flattened epiglottis, when the ulcer is located on its lower surface, or often on the posterior wall of the larynx or in the trachea. For such cases a new treatment recommended by Rudolf Hoffmann, of Munich, namely, injection of alcohol, may be used with benefit. Braun and Valentin had injected cocain into the superior laryngeal nerve in order to produce anesthesia for endolaryngeal operations; but Hoffmann<sup>2</sup> was the first to employ alcohol injections for analgesia of long duration ("Daueranalgesie"). The place where the superior laryngeal nerve penetrates the membrana thyrohyoidea can be felt with the finger, from the outside. If the patient be placed on his back and the larynx pushed toward the affected side, the most painful spot can be determined with the finger. Here the needle puncture is made in a direct vertical line to the body, a little more toward the outside. The needle is inserted to a depth of about  $1\frac{1}{2}$  cm., feeling meanwhile for the spot where the patient complains of the greatest pain, and here the alcohol is injected. Hoffmann recommends 85 per cent alcohol, and of a temperature of  $45^{\circ}$  C., equal to about  $112^{\circ}$  F. The writer has used the same proportion.

After the subsidence of the initial pain, which is sometimes quite severe, another injection is immediately made. Hoffmann advises a strong and somewhat blunt needle, which is preferable, as it avoids the blood vessels and is less liable to break. In making injections with an ordinary hypodermic needle, there is risk of its breaking, and it is a difficult matter, even at present, to extract a needle from the trachea or bronchi of a tuberculous patient. For this reason it is always best to employ a strong needle, and to tell the patient neither to swallow nor to talk until the procedure has been completed.

It is well known that Schlösser was the first to recommend alcohol injections for neuralgia of the face, and many such cases have been cured by him as well as by others. While we do not expect such results, we are quite satisfied if we secure an analgesia lasting from five to ten days. That is all we can expect, and that is indeed a great achievement. Hoffmann himself has found that usually after such injections solid food

was swallowed easily, while it was still unpleasant to drink liquids.

Permit me to present a few of my case histories, the first of which is a most favorable one:

Mr. I. K. R., teacher, aged 43, first consulted me on December 5th, 1909, for severe dysphagia. He was suffering from pulmonary tuberculosis and had had two operations, but at the time of his visit was feeling very badly and was unable to swallow. On examination I found ulcerations on the right aryepiglottic fold on the right arytenoid, and one ulcer a little further down in the trachea. Alcohol was injected, and when the patient returned a week later he told me that while before the operation he could not eat on account of pain, during the past week he had been able to eat well and had had a good appetite. He had remained continuously in the open air, and only the day before had had a slight return of pain. A second injection was made, and the patient went to the country. A week later he returned, having again had slight pain on the same side. After a third injection he again went to the country, and, so far as I know, he has had no recurrence of pain in the past two months. This is the most satisfactory result I have had.

CASE 2 is not so favorable. M. S., male, baker, aged 36; far advanced pulmonary tuberculosis. He complained of severe pain in swallowing, and a scratchy sensation in the throat, resulting in coughing spells. There was an ulcer on the lower surface of the epiglottis, and quite marked edema of the arytenoids, perichondritis, and ankylosis of the cricoarytenoid articulation. Two c. c. of 85 per cent alcohol were injected into the left side November 15th. When I saw him, two weeks later—that is, on November 29th—at the Bedford Station Sanatorium, the perichondritis of the left arytenoid was more marked, but the pain on the left side was gone. However, there was pain on the right side, but no cause for it was found in the larynx. A few days later I was informed that the patient had developed palsy on the right side of the face. When I saw him on December 13th, 1909, the paralysis of the facial nerve was marked, and examination showed that it was due to the condition of the right ear. A mastoid operation was not advisable, on account of the advanced stage of the tuberculosis. However, an injection of alcohol was made on the right



side of the larynx, and, strange to say, the pain on that side almost immediately disappeared, thus proving that analgesia travels along the ramus auricularis nervi vagi from below upward, just as in other cases it transmits painful sensations upward. The pain on the left side, however, returned very soon, and in spite of repeated injections the patient died within the following month of pulmonary and laryngeal tuberculosis.

CASE 3.—Mrs. W. B., aged 39, had caught cold a year before and had been suffering since that time. She was hoarse and had some pain on the left side, which extended to the left ear. On examination an ulcer was found on the left side of the epiglottis, with marked infiltration of the entire left side of the larynx. The first injection of alcohol was made on December 9th, 1909. Immediately after she began coughing, followed by slight vomiting. The cough continued for the following three days, when she again called to see me, telling me that she not only coughed, but had had a constant irritation in the larynx since I made the alcohol injection. On that day, December 12th, the left arytenoid cartilage was much more swollen, as well as the left aryepiglottic ligament. Behind this ligament pus appeared. December 15th the patient reported that there was tickling in the throat, which lasted for a day and then disappeared. She expectorated a thick, yellow mucus having an offensive odor. Laryngeal examination showed that the pus had penetrated the left aryepiglottic fold, being plainly visible now. On December 19th the patient felt much easier, and the abscess had disappeared. While the patient continued to call on me occasionally, she objected to another injection, and on February 15th the same clinical picture was seen as before, viz.: swelling on the left side, which meant pus formation. The question in my mind was whether the abscess had been present before the alcohol injection, or whether it had been artificially produced thereby. As the patient had begun to cough immediately after the injection, it seems probable that pus was present and brought to the surface by the alcohol. At any rate, the patient was relieved. The treatment to be followed in her case will be discussed in the next chapter.

I have treated about ten or twelve other cases, with various results. In most cases, where I succeeded in striking the external branch of the superior laryngeal nerve, there was immediate and marked amelioration of pain, the patient not only



being able to swallow solid and semi-solid food, but also to drink water.

We generally can tell when we have reached the laryngeal nerve by the pain which the patient immediately experiences. The alcohol injection does not cause paralysis of the nerve as in anesthesia, but it produces analgesia which usually lasts from three to eight days, and since there is only analgesia present, no "schluck"-pneumonia has ever been observed.

Interesting in this respect was the case reported above, in which there was on the left side a laryngeal otalgia, that is, a pain in the ear which originated in the larynx, while on the right side there was pain in the larynx of otitic origin, both being ameliorated by the alcohol injections.

#### THYROTOMY.

We now come to the third method of treating laryngeal conditions of tuberculous origin, by thyrotomy or laryngotomy, a procedure which I recommend as a very important factor in curing certain cases. Laryngotomy is practically a new method of treatment, as I was able to find only a few reports on it in literature. Formerly, whenever there was obstruction in a tuberculous larynx, tracheotomy was performed and the patient left to his fate. In the majority of cases he died soon thereafter.

Generally we laryngologists tried to overcome the laryngeal disorders of tuberculous patients by intralaryngeal procedures, so that we meet in American literature reports by only two authors who have done thyrotomy for the above reasons. The one is a surgeon, Dr. A. G. Gerster, of New York, who operated successfully for a tubercular tumor of the larynx; the other is our colleague, Dr. Otto J. Stein, of Chicago, who has published two successful cases.<sup>3</sup>

Of European writers, V. Uchermann, of Christiania,<sup>4</sup> in an extensive and interesting paper read before the Congress at Budapest, reported but one case of tuberculous stenosis of the larynx operated on by laryngotomy.

The following case induced me to perform tracheotomy and open the larynx:

M. K., aged 35, occupation window cleaner, has suffered from pulmonary tuberculosis for six months; sputum positive for tubercle bacilli. He has complained for about four months

of pain in the throat, dysphagia and increasing hoarseness, as well as aphonia and dyspnea. When I examined him at the Montefiore Home in this city, I found ulcerations of both vocal cords, the movements of which, especially on the left side, were very much limited; the ventricular bands were congested, and there was perichondritis of the arytenoids. There was visible a large subglottic mass, the nature of which could not be determined. This was so large that it caused extreme dyspnea, and the patient begged for operative relief; in fact, it was difficult to see how he could breathe at all with this obstruction. As the pulmonary condition was not far advanced, I decided to remove the entire mass by an external operation.

This operation was performed on October 13, 1909, under local anesthesia with adrenalin and cocain. High tracheotomy was done, the cricoid and thyroid cartilages divided in the middle line, the larynx laid open, and then a large mass removed. The interior of the larynx was curetted strongly, and then cauterized with pure lactic acid. The bleeding was very slight. A tracheotomy tube was inserted and the patient removed to bed in good condition. The temperature was 102° F. for two days, soon returning to normal. The general condition was markedly improved. October 30, 1909, the wound was healed, the breathing normal, no subglottic swelling present; the larynx was congested, but no ulceration was visible, and the cords moved freely. The patient was sent to the Bedford Station Sanatorium, and is now feeling very well.

CASE 2.—L. O., male, aged 42, occupation shirt-maker. Father died of tuberculosis. Present illness began about four years ago. Pain in the neck and throat; almost complete aphonia and also marked dyspnea and dysphagia. The lungs showed advanced tuberculosis. The epiglottis was thickened, whitish and irregular. The left arytenoid presented a mass about the size of a large cherry, which concealed the vocal cord on that side. No ulcer could be seen. As this patient was in the same ward as Case 1, and had watched the good results in that case, he begged for an operation. This was performed under local anesthesia, with cocain and adrenalin, with good results. High tracheotomy was done, after which the larynx was plugged with gauze. An incision was made through the cricoid and thyroid in the median line. After the

larynx was laid open, the left arytenoid was removed and about one drachm of pus evacuated through the wound. Then the left ventricular band was removed, also the right arytenoid and the epiglottis, after which the whole interior of the larynx was curetted and cauterized with pure lactic acid. The wound was closed with chromic gut sutures.

The condition after operation gradually became worse. Food was regurgitated through the tracheotomy tube and probably aspirated. The stitches at the upper angle of the wound ripped out, and the discharge was also expelled through this opening. The patient developed pulmonary edema and died within a few days.

In going over this history we ask ourselves whether or not we were justified in performing such an operation in a case so far advanced. The fact is, however, that we were forced to do tracheotomy, as otherwise the patient would have inevitably succumbed from dyspnea. Tracheotomy done, it seemed only a small matter to go a step further and perform thyrotomy, thus affording the patient the only chance of a cure of the laryngeal lesions. Of course, we had no means of knowing how deep these were, from the usual laryngeal examination. Had we known, we would not have opened the larynx.

The next case we intended to operate on was that of Mrs. W. B. (see Case 3). Here we had a typical, almost ideal, condition for this procedure. The woman was in comparatively good health, the lungs not much affected, the only active process apparently being in the larynx. The pus in her larynx was like an active volcano. It was the only cause of her cough, and apparently acted all the time as a source of infection of other parts. Unfortunately, an operation was refused, and nothing further was heard from the patient.

CASE 3.—B. A., aged 25, clerk; has been hoarse since five months; has a cough, and has lost in weight 10 pounds during that time. No night sweats; no tubercle bacilli in the sputum. On examination a somewhat irregular mass was found occupying the largest part of the left ventricular band. The main swelling was in the anterior portion, corresponding to which was an excavation on the right side. That side, however, was apparently normal, with the exception of some injection. The largest portion of the left vocal cord was not visible, on account of the swelling. The condition of his lungs was quite



favorable, only the left apex being found affected. As the man's general condition was good, and in view of the possibility of the larynx being the primary and only active focus of infection, the removal of that focus by thyrotomy was, after due deliberation, considered advisable in the best interest of the patient. This was done January 4, 1910, under cocain-adrenalin anesthesia. After laying open the larynx it was found necessary to remove the left vocal cord and ventricular band in toto. The latter on inspection was seen to be ulcerated. Curetment and application of pure lactic acid were made. The right side of the larynx was not touched, as the pathologic changes were considered secondary to the irritation of the other side. *Cessante causa morbus cessat* proved to be correct.

The patient had quite high fever after the operation. On the fourth day it reached its maximum with 104.2° F. Then it slowly went down, but it did not subside entirely before January 22, 1910, i. e., 18 days after the operation. From now on his recovery was very quick, the patient being out of bed the greater part of the day.

In summing up our limited experience with this operation, we must say that occasionally such a procedure may be unsuccessfully attempted in a hopeless case as the last resort, but in other instances it will tend to prolong the life of the patient and will open a path towards a final recovery. If we had simply done a tracheotomy in Case 1, the man would still carry his tumor with him, this acting as a source of constant irritation as well as a menace to his life. But even such patients without any tumor, as Case 3, should be operated upon by laryngotomy and all the diseased tissue removed. If the lungs, as in this case, are but slightly affected and the larynx is the chief factor in causing trouble, then only radical surgical intervention will prove of service, and this cannot be accomplished intralaryngeally.

Furthermore, if you make many autopsies on persons with laryngeal tuberculosis, you will find abscesses and their sequelæ oftener than you think. Thus, for example in this specimen, pus was found in the neck, of the presence of which we had no knowledge while the patient was alive. That pus came from the interior of the larynx, having made quite a perforation through the thyroid cartilage. In vivo there was seen



a marked infiltration on that side, with ulcerations. Pus had been noted in the larynx, but naturally it was supposed to have its origin lower down in the lungs. That specimen and the case of Mrs. W. B. convinced me that in tuberculous cases the larynx should be opened up oftener than heretofore, so as to permit of direct inspection. With the present Schleich anesthesia the patients can stand the operation better than under a general anesthetic, and those who have fair resistance power will certainly benefit by it.

The question of thyrotomy in cases of carcinoma of the larynx is an entirely different one, and the writer has nothing to add on that point at present.

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## XL.

### THE PHYSIOLOGY OF THE COCHLEA. SAMMELREFERAT.\*

BY GEO. E. SHAMBAUGH, M. D.,

CHICAGO.

Before the work of Cotugno in 1760 demonstrated that the inner ear is filled with fluid it was generally believed that the labyrinth contained air "implanted" in its cavities "aer ingentus." This idea originated with Aristotle in the fourth century B. C., who argued that since the ear is the organ for the air sense it is necessary for it to have the same nature. Since hearing takes place from the air there must be air in the head to respond to the outer air. The persistence of the idea that the labyrinth of the ear contained air did not prevent, however, the gradual development of those ideas regarding the physiology of sound perception which form the basis for the present day views. The Greeks, for example, looked upon this "implanted air" as the actual sense organ. The idea of its physiologic importance was very much diminished long before it was demonstrated that the labyrinth contained fluid, and while the necessity for the ear to contain air was still adhered to. Schelhammer, for example, in 1684 contended that since air was a medium for transferring sound it could not be the actual sense organ itself. The inner air in the ear was, according to Schelhammer, the medium, not the organ, for perception. The organ for perception was the nerve of hearing.

A discussion of the present day theories of sound perception begins naturally with a consideration of the work of Helmholtz. The fundamental conceptions of the Helmholtz theory, viz., that tone perception is dependent on the vibration of structures in the cochlea in response to the impulse of sound waves, and that this response takes place in different

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parts of the cochlea for the tones of varying pitch, were conceptions which had found expression, however, long before the time of Helmholtz.

The idea of the existence in the cochlea of a vibrating mechanism which responds to the impulse of sound waves seems to have been first expressed in the writings of Claude Perrault (1680), who held that the fibers which enter the spiral lamina of the cochlea form with the bony substance a sort of membrane which constitutes the actual end organ of hearing, and which is thrown into vibration by the jarring of the air enclosed in the labyrinth.

The idea that there exists in the cochlea a mechanism which responds in its several parts, depending on the pitch of the tone, was first clearly expressed by Duverney (1683).<sup>1</sup> He believed that the lamina spiralis in the cochlea was an actual end organ for sound perception, which he likened to a musical instrument. Its ability to respond to the sound waves for tones of varying pitch was dependent on its varying breadth from one end of the cochlea to the other. Since the broader shelf of the lamina spiralis is found in the basal coil, this is the part that responds to the low tones, while the narrow lamina near the apex of the cochlea responds to the higher tones. The difference between this conception of Duverney and that of Helmholtz is essentially that the latter had a knowledge of the membranous labyrinth which was not known to Duverney.

Helmholtz selected the membranous part of the spiral partition, the membrana basilaris, as the vibrating structure which responds in the several parts of the cochlea to the tones of varying pitch. Because the radiating fibers of the membrana basilaris are shorter in the basal coil, and become gradually longer towards the apex of the cochlea, Helmholtz placed the perception for the high tones in the basal coil and the lower tones near the apex of the cochlea.

Valsalva (1704)<sup>2</sup> came still closer to the Helmholtz conception of the function of the cochlea in that he placed the mechanism for perception not in the osseous lamina spiralis, as did Duverney, but in the "zonæ sonoræ," membranous bands made up of the branching of the nerve of hearing, which varied in length like the strings of a musical instrument. Their difference in length determined the vibration of the different

bands for tones of different pitch. He also pointed out that the labyrinth of the child has the same size as in the adult, for the reason that a difference in size in different ages must result in tones being heard differently in the periods of growth.

Boerhaven (1668-1738) also held a view quite like the Helmholtz theory. He believed that an infinite number of cords existed in the cochlea, the varying length of which rendered it possible for the longer cords to respond to the low tones, while the shorter cords respond to the higher tones.

Zinn (1753)<sup>3</sup> did not accept the view that the nerve fibers lying between the lamellæ of the membranous spiral partition were thrown separately into vibration. Zinn attributed to bony striæ the ability to vibrate separately for the several tones and thus to transmit stimulation to particular nerve fibers.

Haller (1763)<sup>4</sup> expressed the view that tone perception is dependent on the sympathetic vibration of cords transverse to the long axis of the cochlea. The long cords at the base of the cochlea respond to the low tones, and the shorter cords near the apex to the higher tones. With the exception that he placed the longer cords in the cochlea where the shorter fibers of the membrana basilaris were found to be located, the conception of tone perception held by Haller was quite like that expressed in the Helmholtz theory.

Cotugno in 1760<sup>5</sup> announced the discovery of the fact that the cavities of the labyrinth are filled with fluid and not with air. He subscribed closely to the views expressed by Val-salva regarding sound perception in the cochlea, viz., that the mechanism in the cochlea for tone perception consists of a series of bands the longest of which are located at the apex. He pointed out that since the membranous bands which respond to sound waves are soft and continually pressed upon by the fluid in the cochlea, their vibration could not continue independently, but must cease immediately as the sound waves in the labyrinth fluid ceases.

We see here that the transition from the conception of enclosed air in the labyrinth to that of enclosed fluid altered but little the theory of the physiology of the cochlea.

Goeffry (1778)<sup>6</sup> reverted again to the theory of air enclosed in the labyrinth, but held to the hypothesis that the membranous partition in the cochlea vibrates in response to tone impulses, and since every part of this membrane is penetrated



by nerve fibers, no part can vibrate without stimulating certain of these fibers.

Autenreich (1809)<sup>7</sup> accepted the view expressed by Boerhaven, Haller and others, that the perception of the various tones takes place in separate parts of the cochlea as the result of the sympathetic vibration of stretched nerve fibers.

We see, therefore, in the evolution of the theory of tone perception the development of the ideas, first, that the perception of the various tones is dependent on the sympathetic vibration of structures in the several parts of the cochlea, and second, that it is the membranous structure (the nerves themselves) which respond in this way.

The discovery of the existence of the membranous labyrinth by Scarpa in 1789<sup>8</sup> and of the organ of Corti in 1851<sup>9</sup> altered in no way these fundamental conceptions already existing regarding the physiology of tone perception. With a knowledge of the histologic details of Corti's organ, the view became generally accepted that the hair cell is the actual end organ wherein the transference of the physical impulse of sound waves to nerve impulse takes place. The actual problem in the physiology of the cochlea, therefore, becomes one of determining how the impulse of sound waves in the fluids of the labyrinth brought about a stimulation of these hair cells. It is generally accepted that their stimulation is the result of an irritation applied to their projecting hairs. There appear to be, therefore, but two possible ways for these cells to be stimulated; either the hairs receive impulses direct from the endolymph, or the irritation of the hairs is the result of an interaction with the overhanging membrana tectoria.

The theory that the hairs receive their stimulations direct from impulses in the endolymph without the intervention of the membrana tectoria has had but few adherents. Ayers (1891)<sup>10</sup> expressed the view that the membrana tectoria as a distinct structure does not exist; that what we designate as this membrane is but the result of the matting together of the elongated hairs from the hair cells of Corti's organ. Ayers expressed the view that these elongated hairs received their stimuli direct from the impulse of sound waves passing through the endolymph. This view advanced by Ayers has recently been restated by W. S. Bryant.<sup>11</sup> That the membrana tectoria is a separate structure analogous to the cupula of the

crista ampullaris, and the otolith membrane of the macula acustica is evident. An anatomic objection against the hypothesis that the hairs of the hair cells receive their stimuli direct from the impulses in the endolymph is that we do not find that physical difference between the hairs in the several parts of the cochlea which we would expect to find in a mechanism capable of being stimulated in different parts of the cochlea by tones of varying pitch. Other objections to such an hypothesis are these: In the first place, such a theory must assume that the end organ in the cochlea responds to stimuli in a manner quite different from its analogous structures, the macula acustica and the crista acustica, where we know that the stimulation of the hair cells is dependent on an interaction between their projecting hairs and a superimposed structure, the otolith membrane and the cupula, respectively. In the second place, there exists a fundamental anatomic objection against the hypothesis that the hairs may act independently of the membrana tectoria. This is the relation which exists normally between the hairs and the membrana tectoria. I have been able to demonstrate that this relation is the same as exists between the hairs of the hair cells in the macula acustica and the crista acustica and the otolith membrane and the cupula, respectively. It is a relation normally of actual contact, one which precludes the possibility in any of these end organs of impulses reaching the hairs of the hair cells without the intervention of the superimposed membrane, the otolith membrane in the macula acustica, the cupula in the crista acustica and the membrana tectoria in the organ of Corti.

The principle, however, is now generally accepted that the stimulation of the hair cells of Corti's organ is dependent on an interaction between their projecting hairs and the membrana tectoria. The actual problem in tone perception is further simplified, therefore, into one of determining how this interaction is brought about. Both Hensen and Helmholtz expressed the view that the vibration of the membrana basilaris carries the hair cells upward and brings their projecting hairs in contact with the under surface of the membrana tectoria from which they were supposed to be separated normally by a small space.

Those who have worked with the problem of tone percep-

tion since the time of Helmholtz have almost without exception accepted the hypothesis that the membrana basilaris is the active agent in bringing about the interaction between the hair cells of Corti's organ and the membrana tectoria. E. ter Kuile,<sup>12</sup> for example, notes that the location of the inner rods on the labium tympanicum and not on the membrana basilaris makes it impossible for the organ of Corti to be carried upwards by the vibration of the membrana basilaris, as supposed by Hensen and Helmholtz. He still clings, however, to the idea that the stimulation of the hair cells is dependent on the vibration of the membrana basilaris. This stimulation is brought about, he assumes, by the rotation of the organ of Corti around the inner rod as a fulcrum, thus brushing the hairs to and fro against the under surface of the membrana tectoria.

Ebbinghaus<sup>13</sup> also accepts the hypothesis that the radiating fibers of the membrana basilaris act as string resonators, but assumes that each string depending on the formation of nodes may vibrate in response to several tones.

Max Meyer<sup>14</sup> does not accept the principle of physical resonance, but nevertheless adopts the idea that the membrana basilaris fills the active role in bringing about a stimulation of the hair cells of Corti's organ, and builds up his theory on this hypothesis. According to the theory of Max Meyer, varying lengths of the membrana basilaris, from the base of the cochlea towards the apex, are thrown into vibration, depending on the strength of the tone. The rapidity of the vibration is determined by the pitch of the tone.

Ewald<sup>15</sup> also does not accept the resonator theory, but begins, nevertheless, with the hypothesis that the stimulation of the hair cells is dependent on the vibration of the membrana basilaris. He then constructs his model, having a taut rubber membrane representing the membrana basilaris, and by studying the vibration of the rubber membrane in response to sound waves he attempts to determine the manner in which the membrana basilaris itself responds to the impulse of sound waves in the labyrinth. A fundamental anatomic objection to the principle of the Ewald theory, which does not apply to the other basilar membrane theories, is the relation which exists normally between the hairs of the hair cells of Corti's organ and the under surface of the membrana tectoria. I have been



able to demonstrate, as I pointed out above, that this is a relation of actual contact, the same relation as is known to exist between the hairs of the hair cells in both the macula acustica and the crista acustica and their superimposed membranes, the otolith membrane and the cupula. According to the Ewald theory the entire basilar membrane, from one end of the cochlea to the other, is thrown into vibration for each tone in the scale, the low tones producing longer undulations than the higher tones. Only those hair cells are stimulated which occupy the crests of the waves, where alone the hairs are brought into contact with the under surface of the membrana tectoria. Different groups of hair cells throughout the cochlea are thus stimulated for each tone in the scale. In this way a peripheral tone analysis is accomplished. The theory of Ewald presupposes that the membrana tectoria is separated from the hair cells by an appreciable space. With a normal relation of actual contact established between the hairs of the hair cells and the membrana tectoria, every tone producing vibrations of the basilar membrane from one end of the cochlea to the other must of necessity result in a stimulation of every hair cell in the cochlea. Such a reaction, as Ewald himself points out, would make the phenomena of subjective tone analysis impossible.

All the theories of tone perception that attribute the active role in bringing about a stimulation of the hair cells of Corti's organ to the membrana basilaris must assume that this membrane responds at all times equally to the same impulse. This principle is fundamental and applies as well to the theories of Max Meyer and Ewald as to the resonator theories. If the membrane should not respond equally at all times to the same impulse, there could be, for example, no basis for the recognition of pitch. As I have previously pointed out,<sup>16</sup> there exists an anatomic condition which makes such a response a physical impossibility, and which, therefore, constitutes an unanswerable argument against any theory which places the active role in the membrana basilaris. This anatomic condition is the presence of the blood vessel attached throughout the cochlea to the under surface of the membrana basilaris. This blood vessel, I have been able to demonstrate by injection experiments, is capable of the same distention and contraction, depending on varying degrees of blood pressure, as are the



blood vessels in other parts of the body. It is evident that the vibration of the whole or a part of the membrana basilaris in response to a particular tone will be different when the blood vessel is distended than when it is contracted. There are other objections to the hypothesis that the membrana basilaris is a vibrating structure, which I have pointed out elsewhere (l. c.), but which, it is hardly necessary to mention here, since the presence of the blood vessel under the tunnel of Corti is in itself a fundamental objection.

Since it has been shown that the stimulation of the hair cells of Corti's organ is dependent on an interaction between their projecting hairs and the membrana tectoria, there appears to be but one possible conclusion, and that is that this interaction is brought about by the movements of the membrana tectoria in response to the impulse of sound waves in the endolymph. This conclusion brings the physiology of the organ of Corti into accord with that of the other end organs in the labyrinth, where the stimulation of the hair cells is dependent on the movement of their superimposed membranes, the otolith membrane and the cupula.

The idea that the membrana tectoria takes the active part in bringing about the stimulation of the hair cells is not entirely a new conception. Others have suggested such a function for this membrane, but the arguments as here set forth, showing not only that this is the logical structure for this role, but that it is impossible for the hair cells of Corti's organ to be stimulated in any other way, have not been worked out before.

Hasse<sup>17</sup> appears to be the first to suggest such a role for the membrana tectoria. His argument was that since sound waves enter the labyrinth largely through the oval window they must impinge directly upon this membrane and throw it into vibration. The fact that the membrane is free and not taut, he contends, should render it all the more easily affected by wave movements in the endolymph.

Siebenmann<sup>18</sup> also suggests that since clinical evidence goes to show that sound waves enter the labyrinth through the oval and not the round window, the membrana tectoria would seem to be the structure vibrated first and most vigorously by sound waves. He points out, too, that its variation in size and form in the several parts of the cochlea should be thought of in explaining the differentiation of tones.

Von Ebener<sup>19</sup> expressed himself as agreeing with Hasse that the direct excitant of the hair cells of Corti's organ is the membrana tectoria, and expressed the belief that this membrane is vibrated by the impulse of sound waves passing through the endolymph.

Kishi,<sup>20</sup> on the basis of some sections, photographs of which he published, representing the membrana tectoria flattened out above the organ of Corti, concludes that this membrane is attached at both ends and thus represents a series of taut bands adapted to respond to sound waves in the endolymph. He points out as objections to the theory that the membrana basilaris is a vibrating structure; that its radiating fibers are embedded between cellular layers; that if it were the vibrating structure the hair cells should be placed perpendicularly upon it; that sound waves entering through the oval window must reach the membrana basilaris without irritating the hair cells, which he thinks is impossible, and finally, that the membrana basilaris does not appear suitable to act as a vibrating structure.

In the same year (1907) I published a paper<sup>21</sup> in which I pointed out: That since the stimulation of the hair cells of Corti's organ is brought about by an irritation of their projecting hairs, and since the relation of these hairs to the membrana tectoria makes it impossible for them to receive stimuli direct from the endolymph, this irritation must be due to an interaction with the membrana tectoria. I pointed out also that the membrana basilaris is anatomically incapable of taking the active role of responding to the impulse of sound waves, especially because of its disappearance as a possible vibrating structure toward the lower end of the basal coil, where a perfectly formed organ of Corti is still found. The logical conclusion is that the membrana tectoria takes the active part by vibrating in the several parts of the cochlea to tones of varying pitch, in the basal coil for the high pitched tones, and in the upper coils for the tones lower in the scale. The great variation in size of the membrana tectoria from one end of the cochlea to the other, together with its complex structure, I pointed out as the physical basis which makes it possible for this membrane to respond in the several parts of the cochlea to tones of varying pitch by acting probably on the principle of physical resonance.

The following year (1908) Hardesty<sup>22</sup> published an article on the membrana tectoria, in which he discussed the function of this structure. His conclusions appear to me to coincide in all important points with those set forth in my paper. These are: That the membrana basilaris is anatomically incapable of taking the active role in bringing about a stimulation of the hair cells of Corti's organ; that the hairs of the hair cells are inadequate to act independently in receiving stimuli direct from impulses in the endolymph; that since the stimulation of the hair cells is dependent on an interaction between the hairs and the membrana tectoria this must be brought about by movements in this membrane. Hardesty discussed a number of possible ways by which the membrana tectoria might respond to sound waves, but appears to me to finally accept practically the conclusions expressed in my paper, namely, that areas of this membrane respond in the several parts of the cochlea to tones of varying pitch. He asserts that his conclusions represent a modification of the telephone theory of Rutherford. His modifications, however, seem clearly to constitute a substitution of the principles of peripheral analysis for that of central analysis, the fundamental conception of the telephone theory. This is clearly implied from his explanation of tone islands (page 172), where he asserts that circumscribed chalk deposits in the membrana tectoria could produce this phenomena.

In 1908 I published an article<sup>23</sup> in which I pointed out that the close structural analogies between the several end organs in the labyrinth seem to indicate clearly that the stimulation of the hair cells in each end organ is fundamentally alike in that this stimulation is dependent on the movements of a superimposed structure, the otolith membrane, the cupula, and the membrana tectoria, respectively. I also published some drawings of sections showing the impossibility of the membrana basilaris acting as a vibrating mechanism, and pointed out how the blood vessel under the tunnel or Corti rendered it absolutely impossible for the membrana basilaris to respond the same at all times to the same impulses.

It would seem, therefore, that one cannot escape the conclusion that the stimulation of the hair cells of Corti's organ is the result of the interaction between their projecting hairs and the membrana tectoria, brought about by the vibration of



this membrane in response to the impulse of sound waves passing through the endolymph. An actual demonstration of this response by the construction of a model seems to be out of the question in a structure as delicate and as complicated as the membrana tectoria, especially as we are as yet unable to state what are its exact physical properties. We can hardly expect that attempts to apply exact mathematics and physics in the explanation of the vibration of the membrana tectoria would lead to any very profitable conclusions, at least until we are able to determine more accurately its physical properties. The problem would seem, therefore, to resolve itself into one of determining what plausible mode of response in the membrana tectoria would best explain the phenomena, normal and pathologic, associated with tone perception.

Three possible modes of response suggest themselves. One is that tones highest in the scale produce vibrations in a limited area of this membrane nearest the beginning of the basal coil, where this structure is very small, and that each tone lower in the scale will be able to throw a larger and larger part of the membrane into vibration, until the lowest tones we can perceive will cause the whole of the membrane from one end of the cochlea to the other to vibrate. Such a response, it is evident, would fail to account for the occurrence of tone islands or of defects in the tone scale, nor would it account for the production of circumscribed areas of degeneration in the organ of Corti, as the result of overstimulation by tones of a definite pitch, as demonstrated by Wittmach<sup>24</sup> and Yoshii.<sup>25</sup> Another possible response is that the whole membrane is thrown into vibration for every tone in the scale. Such a response fails also to account for tone islands or for circumscribed areas of degeneration from overstimulation. At the same time, with such a response, the relation of actual contact normally between the hairs of the hair cells and the membrana tectoria would necessarily cause every hair cell in the cochlea to be stimulated for every tone in the scale. This response seems therefore to be untenable not only because it fails to account for the above pathologic conditions, but because it offers no plausible explanation for the phenomena of subjective tone analysis. The third possible mode of response of the membrana tectoria that suggests itself is that circumscribed areas respond in the several parts of the cochlea, each



for a tone of a particular pitch, the higher tones in the basal coil, the lower tones near the apex of the cochlea. The varying size of the membrana tectoria from one end of the cochlea to the other, together with its fibrillar structure, are physical factors which suggest how this response is possible on the basis of physical resonance. Such a response in the membrana tectoria explains most readily subjective tone analysis as well as the secondary phenomena of tone perception, and at the same time accounts readily for the important pathologic phenomena, such as tone islands, diplacusis, and the development of areas of degeneration from overstimulation. It would seem, moreover, that the work previously carried out by Helmholtz and his followers substantiating a resonator theory of tone perception should support such a response in the membrana tectoria. It is interesting also to note that such a response brings the theory of tone perception into accord with the fundamental conceptions expressed as early as 1680 by Claude Perrault, and 1683 by Duverney, that the perception of the various tones of the scale takes place in separate parts of the cochlea and is dependent on the vibration of structures in the cochlea in response to tones of varying pitch.

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## XLI.

### BLACK TONGUE: LINGUA NIGRA VILLOSA. WITH REPORT OF A CASE.

BY CHAS. H. KNIGHT, M. D.,

NEW YORK.

The ease with which the chief feature of *nigrismus linguæ* may be simulated by means of certain pigments, iron applications, etc., has prompted the statement that most instances of alleged "black tongue" are cases of intentional deception, or malingering (Hutchinson). Genuine examples are now numerous enough to exclude this assumption, except perhaps in hysterical young women. The condition seems to have been first fully described by Landouzy in 1845, although the observation of a case is credited to Lusitanus in 1557. In a very complete report by Blegvad in 1907 reference is made to a contribution by Rayer bearing the date 1835. He collected 138 cases, including ten of his own, and at the end of the present paper a few cases are added not found in his list.

The clinical history is not a matter of controversy, but the gross appearances and the microscopic picture are differently interpreted by various observers. By some it is regarded as a vasomotor disturbance allied to chromidrosis of the skin (Armaingaud). The suggestion is offered by S. Solis-Cohen that the subjects of this condition belong to that class of vasomotor defectives who often show a proneness to deposit of pigment in areas exposed to irritation, or in which the blood current is for a time slowed. He regards it as "a local proliferation, probably excited by the presence of microbes," the latter not necessarily specific. He discovers no connection with gastric disorders or with systemic infection. The tendency has been to accept a parasitic origin, although the alleged micrococcus, first described by Raynaud (1889), is always found about the filiform papillæ and forms a large constituent of the natural fur (Butlin, 1885). From a study of two cases

in healthy women, from 50 to 70 years of age, Carl Böcher (1887) concludes that microorganisms are the causative factors, since he found the affected papillæ buried in a granular mass entangling mycelial threads and many spores. Fairlie Clarke (1872) quoted Hyde Salter (1852) as referring to cases in which the filiform papillæ are enormously elongated and of a dark sepia color, due to pigment granules, but he himself offers no opinion as to cause. The same *mucor niger* has been applied by Ciaglinski and Hewelke (1893) to an organism found in the scrapings of a lesion and believed to be the etiologic factor. A similar organism was discovered by Sendziak (1894). A black mould found and cultivated by Schmiegelow (1896) is regarded by him as pathogenic. On the contrary Schech (1887), who at first espoused the parasitic theory, now adopts the idea of hyperkeratosis, the papillæ being enlarged and cornified, in which he is followed by Brosin (1888). A similar opinion is held by Haenisch (1908), who after a careful review of the pathologic anatomy and etiology of black tongue, holds that the fungi occasionally have no etiologic importance whatever. The microbic idea is rejected by Wyatt Wingrave, after examination of a case exhibited by Abercrombie (1901), that of a man of 32, whose attention was drawn to his tongue by persistent tickling in the roof of his mouth and a peculiar sweetish taste. In the scrapings from a black patch in the usual situation were found a large variety of bacteria commonly occurring in the mouth, the hair-like appearance being attributed to cleaving of the papillæ with keratinoid degeneration and pigmentation of the cells. Similar results in six other cases confirmed these conclusions.

After a very critical analysis of his own cases (10) and of the literature of the subject, Blegvad (1907) decides that the parasitic theory is not tenable. He finds no difference microscopically between black tongue and the ordinary furred tongue, and quotes Müller and Fuchs, who distinguish two varieties of furred tongue. In one, the genuine, the fur is made up of epithelial debris, leucocytes, moulds, food particles, etc.; the other kind, not genuine and more likely to be confounded with black tongue, is composed of keratosed, elongated filiform papillæ. His attempts to cultivate the mould scraped from the tongue in each of his cases developed many colonies of bacteria, but no brown or black moulds.



Although his microscopic examinations as well as most of those of others, have been limited to the papillæ and have not included deeper structures, where more positive signs of inflammation might be seen, he believes that the lesion begins as a slight glossitis or stomatitis resulting in prolongation of the papillæ, which afterwards become discolored by contact with certain ingesta, or by drugs taken internally and eliminated by the mouth. He found it neither infectious nor inoculable, and all experiments by others in this direction have failed. He also combats the hyperkeratosis theory, maintaining that "papillæ from normal tongues on an average are just as much keratosed as those from black tongues." The researches of J. L. Goodale (1900), which included underlying tissue together with affected papillæ, seem to prove that the lesion is primarily a glossitis and that alterations in the epithelial cells are secondary. The color is thought to be due to the presence of certain "highly refractile pigmented granules" associated with a "characteristic bacterium." From being a personal experience, the case of H. Arrowsmith (1909) has peculiar interest. He accepts the nonparasitic view, as implied in the term hyperkeratosis, which is still further established by microscopic examination of excised papillæ made by Archibald Murray. Two points in his history are noteworthy: First, the location of the patch quite to the left instead of, as usual, in the median line; and second, its spontaneous disappearance in about ten days.

Subjective symptoms are entirely absent, or may be limited to a localized feeling of dryness, or tickling, or of a foreign body. For this reason, probably, the condition is not often observed. In one of two cases reported by R. H. Johnston (1903) a sticking sensation in the tongue was complained of, but otherwise nothing extraordinary was noted. Nothing especial attracts the attention of the patient, and its discovery is often quite accidental. The affection has only an academic interest, both for the foregoing fact and because treatment seems to have little or no effect. Gradual extension of the staining over a limited area, or even to the whole dorsum of the tongue, followed by slow, spontaneous fading from the periphery towards the center, has been the general experience. The staining is totally different in character from the melanotic spots sometimes seen in the buccal cavity in Addison's disease

in conjunction with the characteristic bronzing of the skin. Butlin asserts that most cases are in poor general health, and that tonics are indicated, although he is not very enthusiastic about the result of any kind of treatment. Of three cases described by Lannois (1888) one occurred in a young girl with Pott's disease, one in an old tabetic subject, and one in a man of 62 with dysentery. Black tongue is said to be frequently developed in diabetes (Horand and Weil, 1888). Levisseur (1889) reports a case in a syphilitic and expresses the belief that it is most frequent in those debilitated by age or disease. Certainly the records seem to sustain the idea of a probable constitutional element. The senses of taste and of touch and the motility of the tongue are not affected. On the other hand Schech affirms that disturbance of the sense of taste may lead the patient to consult a physician. The latter authority also refers to the etiologic theory of Dessois that the affection is caused by a special fungus (*glossophyton*) not otherwise found on the tongue (?). In some cases the sense of taste is said to have been actually exaggerated or even painful.

The duration of the disease is extremely variable, from a few days to fifteen years (Sell, 1879 and 1885). Lambert Lack mentions a case having persisted "some years." Others have been known to terminate within a few weeks. The majority of cases have been noted in young people. In one cited by Butlin, a woman of 83, the hair-like papillæ loosened and fell off at the end of about a year. Desquamation is said to be common and relapses are not infrequent. In one of several cases seen by George Stoker (1890) the subject was a little child, who was also the victim of certain specific throat manifestations. A case reported by Rydigier (1891) was only 14 years of age, while Delefosse and Sahlé (1908) observed a case in a nursling.

Aside from the distinctive color the area involved has a curious, tufted, shaggy appearance owing to lengthening of the papillæ and their hair-like prolongations. The picture is likened by Schech (1887) to the "nap of a black silk hat rubbed the wrong way." His examination convinced him that the disease is not a mycosis, but is composed simply of hypertrophied, pigmented and horny papillæ. With finer fancy, Raynaud compares it to "a field of corn laid by the wind and rain." In the majority of cases a single patch is seen in

the middle line of the tongue in front of the circumvallate papillæ, but Grünwald (1903) describes and figures a case in which the patches were multiple, from light brown to black in color and produced, in his opinion, by hypertrophic cornification and pigmentary degeneration of the filiform papillæ. As to the color, while as a rule it is decidedly black, it may be light brown, or even blue or green. Changes in color may take place if the patch persists, and sometimes it looks simply like a white fur of unusual degree. In this connection it is interesting to note the fact, to which attention has been called by Butlin, that bacteria possess a remarkable capacity for assuming various tints. While they may have no other relation to the lesion, it is possible that they have some bearing upon this phenomenon.

Treatment, if considered necessary at all, is of doubtful efficacy. It is hard to place a just estimate on medication in a disease that is known to subside spontaneously. In one case reported by Masters and Smith (1891) recovery was complete in three weeks without treatment, and in another a cure seems to have been effected in a few days by the internal use of a mixture of nitric acid and nux vomica and a mouthwash of lemon juice. In Arrowsmith's case the patch disappeared in ten days without treatment, and there has been no return. The local use of a five per cent solution of salicylic acid mixed with a five per cent collodion solution followed by frequent applications of hydrogen peroxide was employed with success by Semon (1897), in accordance with a suggestion made by Unna. Brosin refers to a cure resulting from chlorate of potash gargling and mentions another case relieved by curetting (Genzner). Altogether, unless to ease the mind of the patient, there seems to be no reason for an energetic attack. The disease is perfectly innocuous in its course and consequences, so that any apprehension of malignity may be dismissed. It may appear in either sex or at any period of life. Of the cases on record a large proportion have been under middle age, and the male sex largely predominates, a fact perhaps explained by the habitual use of tobacco.

At the present time there is no evidence pointing to the existence of a causative organism. In fact, the question of etiology remains unsettled. The history of this phase of the subject is interesting, if fruitless, and is a striking commentary



on the propensity of the human mind to draw false conclusions from what the eye is supposed to see. No less than fifty different kinds of bacteria have been found in the mouth. All of these have been seen in perfectly healthy mouths, not one has been detected invariably present in black tongue, and their proportion bears no relation to the extent or intensity of the lesion. All of which would seem to dispose of the parasitic theory. The effects of mouth-breathing, of the immoderate use of tobacco, of chemical changes in the saliva have been given importance in accordance with the standpoint of the observer, but are still undetermined. As a matter of fact, some cases have been mouth-breathers and others not, some have been users of tobacco and others abstainers, while as to associated change in the character of the saliva it is quite as reasonable to suppose that it is dependent upon the same cause that is responsible for the tongue condition as that the former causes the latter.

The following case answers the description given by nearly all who have written on the subject.

The patient is a gentleman of middle age, of good habits and health, but of rather nervous temperament. He is more or less catarrhal, but the buccal secretions seem to be normal, and he has exceptionally good teeth. His digestion is good and he is reasonably careful in his diet. He is an immoderate smoker, but never drinks to excess. There is no history of gout nor rheumatism. It is impossible to discover a local or a constitutional cause of the condition. Many months, perhaps a year ago, he was startled by seeing a black spot on the middle of his tongue near its base. As it gave him no unpleasant sensation he paid but little attention to it. Looking at it at long intervals he found it was slowly spreading. At the present time it is about the size of a silver dollar and extends from just in front of the circumvallate papillæ almost symmetrically on either side of the median line. It is black at the center and becomes brownish at the circumference. The papillæ composing it are much longer than normal and are so attenuated at their ends as to resemble coarse black hairs. On separating the papillæ with a probe their bases are seen to be of lighter color, reminding one of wet chamois skin. The patch is moist and there is no apparent deficiency of saliva. There is absolutely no sensitiveness, and the con-



tact of the probe is instantly appreciated. The sense of taste is not in the least impaired. The only subjective symptom is a sensation of dryness and, as the patient expresses it, "food seems to adhere in the act of swallowing." Not sharing my scientific interest, he would not permit a microscopic examination of the papillæ. It is not likely, however, that anything can be added to what has already been done in this line by Blegvad, Goodale, Wingrave and others. He was given a two per cent watery solution of protargol with which to paint the patch once a day and was directed to rinse the mouth thoroughly with borolyptol after eating. He reports that the stain gradually faded until within a month no trace remained, although he obeyed instructions only as regards cutting down his use of tobacco.

While the preceding recital adds nothing of value to the history or pathology of "black tongue," it may serve the purpose of calling renewed attention to the etiologic importance of the vasomotor system. In our quest for germs and in our study of the internal secretions the rôle played by the nerves in the causation of certain elusive and obscure affections may have been neglected. It is not unreasonable to suppose that each of these factors is concerned to a greater or less extent in every pathologic state. The difficult matter in a given case is often to decide which predominates. In the disease under review it seems clear that bacteria are subordinate, changes in the salivary secretion are so insignificant as to be of doubtful consequence, and it remains to determine how far the nervous system is a causative agent in the curious phenomena by which it is attended. In this direction a comparison of the effect of passing across the skin of the cheek or forehead probes made of different metals—silver, nickel, copper, aluminum, gold—would be of interest (Cohen). Moreover, careful investigation might disclose various signs which are supposed to indicate functional disturbance of the sympathetic nerves.

120 W. Fifty-seventh Street.

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## XLII.

### CARCINOMA OF THE UVULA.

BY E. M. HOLMES, M. D.,

BOSTON.

Primary malignant disease of the uvula is a comparatively rare disease.

Newman,<sup>1</sup> in 1896, reported a case of adenocarcinoma of the uvula extending into the soft palate and tonsils. No recurrence for six years.

Lennox Brown<sup>2</sup> reported two cases in 1899; one of these died in nineteen months.

Kyle<sup>3</sup> in his text book, 1899 edition, page 231, gives grave prognosis in malignant disease of the uvula.

Zurakowski<sup>4</sup> reported a case in 1899.

Oppenheim<sup>5</sup> saw one in a man 81 years of age in 1901. No operation was performed.

Raynor<sup>6</sup> operated upon a case of malignant growth of the uvula in a man 66 years of age. This recurred in five months.

Freedman,<sup>7</sup> in 1905, reported four cases.

Harmon Smith<sup>8</sup> reported a case of operation for carcinoma of the uvula in a man 51 years of age. Operated second time at end of three months. There was no recurrence at the end of five months.

Downie<sup>9</sup> reported three cases in 1909. One of these cases he had operated upon and reported in 1899.<sup>10</sup> This man died of carcinoma in the posterior triangle of the neck, but there was no recurrence at the original site of the disease.

Case 2 was in a woman of 41 years. She was well for nearly four years after the operation, when the left tonsil became carcinomatous. The deep cervical glands were also carcinomatous.

Case 3 was a man 64 years of age, who was operated upon in 1909.

McCaw<sup>11</sup> operated upon a carcinomatous uvula in a woman

31 years of age and followed the operation by X-ray treatment. At the time of the report there had been no return of the disease.

Theisen<sup>12</sup> reported in 1901 to this society a case of carcinoma of the uvula occurring in a man 52 years of age. There was no recurrence at the end of fourteen months.

In 1908 Milligan<sup>13</sup> exhibited a specimen before the laryngologic division of the Royal Medical Society of London. The patient from whom specimen was removed was a man 62 years of age.

In reporting this case of epithelioma of the uvula I wish to emphasize several points of interest and importance.

In the first place, a new growth in this locality can be easily removed if only the operation can be performed in the early stages of development before it has spread into the palate and into the tonsillar area.

Early in the disease there is much less chance of the cervical lymphatics being infected, and there is, of course, much less of the surrounding tissue to be removed and therefore there is much less resulting deformity.

The chances of recurrence are very much less when there can be an early diagnosis and an immediate excision of the growth and adjacent structures.

It is evident that it is of the utmost importance that an early diagnosis be made of any indurated swelling or growth occurring in this locality, whether it presents an area of necrosis or not. In any case, the patient should be informed of the importance of having a microscopic examination of a portion of the growth, and plans should be made for an immediate operation if the examination proves the growth to be malignant.

There is particular reason for haste in removing malignant growths from this locality, as the lymphatics drain into the submaxillary and deep cervical glands. The deep cervical glands, lying as they do in a network of vessels and nerves, including the sympathetic plexus, make it no easy matter to thoroughly remove them, even when there is no disease present. When malignant disease, originating in the uvula, has extended into the soft palate and into the faucial pillars and tonsil, as it did in this case, it is no easy matter to dissect about it with any feeling of assurance that the whole diseased area has been removed.



The diseases which may simulate in appearance carcinoma of the uvula are syphilis, tuberculosis, traumatism, Vincent's angina and pemphigus. Of these, syphilis is by far the most common. A necrosing syphilitic gumma may produce absolutely similar appearances macroscopically to those produced by malignant new growth.

When syphilis is present we may find other lesions of this disease. We also frequently have a clear history of the disease having existed. Even when we have other signs of syphilis and are fairly sure the disease has existed in the past we cannot feel at all positive that we are not dealing also with a malignant disease. Especially is this true if the condition is in a person past middle age. If there is doubt, the aid of a skilled pathologist should be sought. Had this been done early in the case we are reviewing, the chances are that a simple operation could have eradicated the disease. Occasionally a tubercular ulceration may produce a similar appearance to carcinoma, but it is very rare to have a tubercular ulceration of the uvula, and when this does occur there is almost always a tuberculosis of the lungs.

I have seen one case of thickened swollen indurated uvula with a foul sloughing area extending into the palate, where the spirillum and fusiform bacillus of Vincent were found. This was in a young man 22 years of age, who gave a history of a similar appearance in the tonsil a few months previously.

Trauma of the uvula is rare, and the history would likely easily decide the diagnosis.

About five years ago I saw at the Newton Hospital a uvula which presented a sloughing area surrounded by a nodular granular surface. This patient, a woman, had had pemphigus in both eyes and had a fresh blister inside the right cheek. The lesion upon the uvula was said to have begun as a blister and was probably due to pemphigus.

Tuberculosis, Vincent's angina, trauma, and pemphigus so rarely produce a condition in the uvula simulating malignant growth that we need hardly to consider them.

If operated upon early in the disease, the prognosis in malignant disease of the uvula, so far as recurrence, should be as favorable as when the same disease attacks the lips or cheek. When much of the soft palate has to be sacrificed, there follow the disagreeable conditions found in congenital

cleft palate. The speech is changed and there is often difficulty when swallowing liquids to prevent their passage into the nose.

When the disease has progressed, not only must there necessarily be much of the surrounding tissue sacrificed, but there is much more liability of there being an infection of the lymphatic glands.

When a new growth located in the uvula has not advanced, the operation is a comparatively simple one, but often, as in this case, the process has extended into the pillars and into the tonsillar tissue, and the operation is not an easy one. The question must always arise, shall we remove the glands into which this area drains? Were it a simple matter to remove those glands, and were there not an accompanying shock, it would be good surgery to remove them, whether they were apparently diseased or not. But one side is as liable to be affected as the other, and both sides may be affected at the same time. Also the glands may be infected on the side showing less marked advance in the original growth. For these reasons it would not seem advisable to remove all the glands at the time of the first operation unless there were some signs of disease in one or more of them.

On September 21, 1908, Mr. D. C. consulted me for an ulceration upon the soft palate, and gave the following history:

His father and mother both lived to advanced age and died after short illness. One brother died of cancer about two years before.

Until the beginning of the present illness he had always been perfectly well. About eight months before there began to be a stiff feeling in the palate (uvula). It was sore, but not painful, except when trying to swallow. Even when eating, the pain was not serious at first. After about three weeks the patient noticed that the uvula was swollen and looked inflamed. He consulted his family physician, who gave him a careful physical examination and examined the urine. This physician said there was no organic trouble found, and the swollen uvula was likely due to some injury. He prescribed a gargle to be used every three hours. After using this wash about two weeks there appeared a little raw place at the end of the uvula, which was very sore and painful. At about this time a throat specialist was consulted. This man asked many

questions and finally told him there must have been at some time some venereal disease which he had not noticed or had forgotten. This physician painted the ulcer with some hot wash and gave a salty-tasting medicine, twenty drops in water after meals. For about four weeks the throat was treated locally three times each week. The salty medicine was increased to 60 drops after each meal.

The symptoms grew gradually worse, and the treatment was discontinued for ten days or two weeks. He was now examined at the throat department of the Carney Hospital. He was here given more of the salt medicine. Not being satisfied, the Massachusetts General Hospital was next visited. Here he was told an operation might give him relief. Unfortunately some friend advised him to consult some outside physician, who laughed at the idea of an operation and said he would surely cure him in three months' time. Now followed more internal treatment and local applications to the throat several times each week for three months. There was no improvement. At this time the patient consulted a throat specialist, who told him that he might have syphilis, but he believed he had malignant growth and advised an operation. This last examination was about ten days before he came to my office.

I found Mr. C. to be a well-nourished and healthy appearing man. The blood vessels of the face were somewhat dilated, giving a florid complexion. His speech was similar to one having cleft palate. The heart was normal, the arteries somewhat hardened. The blood pressure was 155 mm. of mercury. The urine was 1023 sp. gr. No albumin, no sugar, only an occasional hyaline cast was present. There were no enlarged glands found anywhere, neither were there areas of pigmentation or periosteal thickening. The nose was normal. Both ears showed thickened drum membranes, and there was considerable loss of hearing.

The uvula was gone and at its site was an ulcerated granular area surrounded by a nodular growth, which extended about one-half inch upon the right side and over the whole lower edge of the left side into the faucial pillars. Above this area the nasopharynx was apparently normal. There was no swelling of the deep cervical glands.

I advised immediate operation, hoping to be able to remove



all of the affected tissue. The patient did not decide to be operated upon until September 29th, when he was admitted to St. Elizabeth's Hospital and was operated upon the following day.

He took ether very poorly, and when finally he was thoroughly anesthetized it was found impossible to use the Whitehead mouthgag. We could not control the tongue to prevent choking. We were obliged to use a Denhardt gag and controlled the tongue by forceps and depressor.

The growth was removed by beginning on left side below pillars and tonsil and dissecting upward. The hemorrhage was hard to control, and so much time was necessary to keep field sponged that progress was slow. Finally we were successful in removing the pillars and tonsil, after which it was the work of but a moment to remove the soft palate. So far as possible the mucous membrane was approximated and sutured. Dr. Leary examined the mass removed and reported the structure to be that of a carcinoma. The convalescence was normal and a perfect cicatrix formed, except at the upper left border, where a granular node formed, and on November 19th I removed this with the surrounding tissue. Dr. Mallory examined the specimen and pronounced it to be a carcinoma. There has been no return of the disease locally, but on November 28th, 1909, the patient came to me for swelling in the right side of the neck, accompanied by pain. There was swelling of the deep and superficial cervical gland of the right side and also one gland under the right side of the tongue.

The patient was informed of the serious nature of his condition and the difficulty of removing the same. He finally decided to an operation for the removal of the affected glands, and on December 2nd he was admitted to St. Elizabeth's Hospital.

The following day I tried to remove all of the glands in this side of the neck. It was found impossible to make a clean dissection, as several of the glands were softened and necrotic. We used great care, but one of the glands ruptured and discharged into the wound. We so far as possible removed all of the diseased structures, but the condition was so extensive that the result seemed very doubtful.

The patient made a rapid recovery from this operation. The wound granulated and filled in rapidly and, excepting a



slight granulation at lower portion, was healed at the end of two weeks.

The patient complained of considerable stiffness and pain in the right side of the neck. There was an indurated feeling below the cicatrix in wound, no more than would usually be present after the normal healing of a similar wound.

January 29th the patient came to me complaining of much more pain, which was located behind the ear. There was a swelling about three-fourths of an inch in diameter situated behind the sternomastoid muscle. One week later this was fluctuating, and an incision opened into a cavity filled with pus and necrotic material. For three days patient was much relieved, but on the fourth day there was a chill, and there developed an erysipelas of the right side of neck and face. He recovered from this within a week, but rapidly lost strength, the whole right side of the neck gradually became involved, there was much pain, and very little nourishment was taken, and he is now nearing the end.

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### XLIII.

## SYPHILITIC STENOSIS OF THE NASOPHARYNX.

By J. M. INGERSOLL, A. M., M. D.,

CLEVELAND.

All of us know how difficult it is to prevent the contraction of syphilitic scar tissue in the nasopharynx or larynx. In the oropharynx the difficulties encountered are even greater. Syphilitic adhesions between the walls of the pharynx and the base of the tongue tend to contract concentrically and gradually shut off the mouth from the esophagus and larynx and thus interfere with respiration and deglutition.

The following case of syphilitic stenosis of the oropharynx is reported because the contraction of the scar tissue has not yet been successfully prevented, and the author hopes that the fellows of this association will suggest some methods by which the difficulties may be overcome.

The patient, a man eighteen years old, was seen first in June, 1909. About two years before this date he had had a primary leutic infection. From the history which he gave it would seem that tertiary lesions had developed in the throat early. The throat had been very sore, and he had had increasing dyspnea and dysphagia. When I first saw him he was having considerable difficulty in swallowing even liquids, which regurgitated through the nose, and solid foods could not be swallowed at all. Except for a small spur the nasal fossæ were normal. The nasopharynx was almost completely closed by syphilitic scar tissue, uniting the posterior pillars and the soft palate with the pharyngeal wall, leaving an opening about one centimeter in diameter. The uvula had disappeared entirely.

Just below the level of the tongue syphilitic scar tissue could be seen extending across the oropharynx, uniting the lateral and posterior walls of the oropharynx with the tongue. About in the center of this scar tissue there was an opening one-half

of a centimeter in diameter through which the inspired air and food must pass. The opening was so small that it was impossible to secure a view below it. The breathing was labored. He had been losing flesh constantly and was quite weak and emaciated.

A free incision was made from the opening in the scar tissue to the lateral wall of the pharynx on each side under cocain anesthesia. A good view was then obtained of the larynx. All the structures below the scar tissue seemed to be normal. There was very little hemorrhage, and the patient was able to eat with a considerable degree of comfort on the following day. He rapidly gained in flesh, and when he was discharged from the hospital failed to report again for about a month. At that time the scar tissue was beginning to contract again, and another incision was made on each side into the pharyngeal walls. During the night following the operation he had considerable hemorrhage. A few days later he was given a rubber bougie and instructed to pass it into his oropharynx several times a day and hold it in position as long as possible. He then left the hospital and failed to report for observation and treatment for five months. During this period he had been fairly comfortable and had neglected to use any sort of bougie, and the scar tissue had again contracted. Incisions were again made through the scar tissue, and he was given two oval metal tubes of different sizes, with careful instructions so that he might use them and prevent the contraction of the scar tissue.

Unfortunately the patient has failed to carry out the regular dilatation with the tubes, and there is a constant tendency for the original condition to return.

Dr. B. F. Curtis reported a similar case, in which the pharynx was almost completely shut off by scar tissue. At the base of the tongue the scar tissue closed the oropharynx, except for a small perforation about a quarter of an inch in diameter. In this case a preliminary tracheotomy was done. Then a transverse incision was made on the left side above the hyoid bone, and the pharynx was opened between the epiglottis and the tongue. The scar tissue forming a web across the oropharynx was then divided. A flap was made from the skin on the left side of the neck five inches long and two inches broad, and was reflected upward so that its raw sur-

face was brought in contact with the raw surface in the oropharynx and sutured in position. Rectal feeding was carried on for several days and the flap healed in good position. After the first week the patient was fed by a stomach tube cautiously passed through the mouth. Twenty-four days after the first operation the flap was dissected back from the external edge of the opening into the pharynx and united to the mucous membrane of the pharynx. The edges of the external opening were sutured into position and the raw surface on the neck was covered with skin grafts.

Rectal feeding was again given for four days. Then the patient was allowed to swallow soft food by the mouth. Swallowing was difficult at first, but the function of the pharyngeal muscles was soon restored. After the external wound had completely healed, the tracheotomy tube was removed. There was very little, if any, tendency for the scar tissue in the oropharynx to contract. The transplanted skin in the pharynx soon assumed the appearance of mucous membrane, and the patient was apparently perfectly cured.

Dr. Curtis also mentions a case reported by Dr. Park in which it was necessary to do a tracheotomy and gastrostomy because the patient was too irresponsible to allow systematic treatment by dilatation.

Dr. Vansant reported a case of syphilitic stenosis at the base of the tongue, in which four extensive operations were performed, excising the cicatricial tissue without favorable results, and the patient finally died of inanition, refusing to have a tracheotomy done.

Dr. J. E. H. Nichols read a paper before this association at its eighteenth annual meeting describing a method devised by him for severing the syphilitic adhesions between the nasopharynx and pharynx. He passed a curved needle through the opening in the scar tissue and carried it as far laterally as the radius of the curve would permit and brought it down through the adhesions and then tied the ends loosely so as not to strangulate the enclosed tissue, leaving it in position for a week, during which time the edges of the little canal around the loop became cicatrized, firm tissue. The loop was then cut and withdrawn, and the intervening tissue between the new opening and the original opening was severed with a knife. The narrow band of cicatrized tissue at the end of the



incision was enough to prevent union between the free edges of the incision.

Dr. G. A. Leland reported a case in which stenosis of the oropharynx was relieved by the method devised by Dr. J. E. H. Nichols. Part of the scar tissue on the right side of the pharynx was included in a suture, tied loosely and left in position. The suture was renewed several times, and in about two months' time it had cut through the tissue so that the opening through the scar became large enough to permit the patient to swallow liquid and semisolid foods. Several months later the same procedure was adopted on the opposite side and the opening in this way considerably enlarged. No mention is made of the length of time that the patient was under observation, and hence there is some doubt in regard to the ultimate result.

Dr. C. K. Briddon reported a case in which the incision was made through the scar tissue, and the tendency to contraction was combated by the patient using a soft rubber bougie twice a day. The case was under observation only two months, however, and the final result is not known.

Dr. W. H. Battle reported a similar case under observation for several months, in which there was a constant tendency to contraction.

Dr. Mesny in 1893 collected the report of thirty-four cases of cicatricial stricture at this level and stated that the scar tissue did not tend to contract. This opinion is not upheld by the reports of the cases which have been under observation for six months or more. In fact, the chief difficulty in the treatment of such cases is the prevention of the contraction of the scar tissue.

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## XLIV.

### SOME CASES OF OTITIC MENINGITIS.\*

BY J. E. SHEPPARD, M. D.,

BROOKLYN.

CASE 1.—Eugene W., aged 29, male, German, a brewer, was admitted to my service in the Jewish Hospital, May 26th, 1909, and came under the care of my associate, Dr. Stickle, to whom I am indebted for the following history:

There had been a discharge from the left ear since childhood following scarlet fever, accompanied by more or less tinnitus and deafness. A week ago the discharge became somewhat bloody. The present illness dates back to five days ago, when he began to suffer from severe throbbing headache, at first frontal, and, spreading until it seemed to involve the entire head, became constant and intense. The following day there was added to the headache a marked degree of dizziness, but as yet no fever. The third day projectile vomiting developed. The fourth day there was some amelioration of all the symptoms, but on the fifth day he again began to vomit, had fever, headache returned with severity, and the neck began to feel stiff. There was no pain in the ear or behind it. On admission to the hospital late on this, the fifth day of his illness, the patient was suffering from terrible headache, referred to the whole head, there was rigidity of the muscles of the neck and back, the head being much retracted, there were spastic seizures of the right arm and leg, a considerable degree of lateral nystagmus, Kernig's sign present on both sides, tache cerebrale well marked, reflexes were normal; most of the left tympanic membrane was gone, and the tympanic cavity was partially filled with granulations.

Examination of the eyes showed moderate dilatation of the pupils, which were equal, reacted rather sluggishly, and the eye-grounds were normal.

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\*Read at the annual meeting of the American Otological Society, held in Washington, D. C., May 3-4, 1910.

As a result of spinal puncture there was removed 40 cubic centimeters of opaque spinal fluid, which showed 95% of polymorphonuclear cells, 4% of mononuclears, and 1% of endothelial cells, and from it there developed in the incubator the bacillus mucosus capsulatus, the same germ being found also in the material removed from the mastoid antrum and in the intradural pus.

On May 27th, the day following his admission, a radical mastoid operation was performed; a relatively large necrotic destruction of the external semicircular canal (more than half of the exposed portion) was found; the dura was opened through the floor of the middle cerebral fossa, attended by the escape from within the dura of a considerable amount of fluid pus, and two iodoform drains were introduced, one as far upward as possible, the other inward along the floor of the fossa.

Shortly after the operation the right pupil became widely dilated, and remained so for two or three weeks, during which time, however, the eye-grounds remained normal.

There was a facial paralysis, which developed on the second day after the operation and disappeared to a great extent within a few months. As soon as he was well enough to leave his bed there was found a great unsteadiness of gait, which persisted for two or three months, but finally equilibrium was completely re-established.

On May 28th a blood culture was taken with a negative result.

On May 26th there were 18,400 leucocytes, with 75% of polymorphonuclears.

On May 27th there were 12,600 leucocytes, with 74% of polymorphonuclears.

On May 29th there were 10,000 leucocytes, with 76% of polymorphonuclears.

On May 31st there were 10,500 leucocytes, with 70% of polymorphonuclears.

The temperature a few hours after the operation reached 105°, the following day 103°, and the same eight or nine days later; the rest of the time it varied from 101.5° down to normal, at which latter point it remained after June 9th or 10th, two weeks after the operation.

In this case the pathway of infection was unquestionably



through the external semicircular canal and internal ear to the intradural space. In spite of the fact that the blood examination gave evidence of a fair amount of resistance on the part of the patient, yet the symptoms preceding operation, together with the escape of so much intradural pus at the time of operation, combined to make the case a seemingly hopeless one.

I saw Mr. W. about ten days ago, April 22d, and found his facial paralysis almost cleared up, equilibration apparently perfect, and, what was of particular interest to me, that he hears as well, or better, than before his operation.

The tuning forks from the vertex were heard entirely in the operated ear, and the absolute duration of the C fork (128 V. S.) by air conduction 0, by bone conduction 20" the C<sup>111</sup> fork (1024 V. S.) by air conduction 8" by bone conduction 14". Showing, I would say, normal labyrinthine hearing and that his cochlea had not been involved at the time of his acute labyrinth infection.

CASE 2.—Mr. D., aged 62, was sent in to my service at the Long Island College Hospital, January 11th, 1910, from Setauket, Long Island, where he had been following his occupation as an oyster planter until five days previously. On that day, and increasingly since then, he was found to be distinctly aphasic, and complained of pain in the left ear and side of head. There was scanty discharge from both ears, and Dr. McCrae, who was in charge of him at his home, believing that the drainage from the left ear was insufficient, made a free incision of the left tympanic membrane three days before he came to the hospital.

I first saw him late in the evening of January 11th, and found him so deaf and so aphasic that it was virtually impossible to obtain any information from him. His brother informed me that he had had recurrent ear trouble in his right ear for many years, and in the left ear for not more than four or five months. He had not been specially ailing during the winter, but had attended to his very exposing work until five days ago.

There was pus in both external canals, an old perforation in the right membrane, and the recent, still open, incision in the left. No evidence of mastoid tenderness could be elicited. Temperature was 101°, pulse 76, respiration 20. Frequent

hot douching of the ears was ordered, also a calomel purge.

The next day, January 12th, he slept at intervals during the day, without much evidence of pain, although he could not speak so as to be understood. Temperature, 8 a. m.,  $101^{\circ}$ ; at 12, noon,  $104^{\circ}$ ; at 8 p. m.,  $102.4^{\circ}$ . Pulse about 100 through the day.

He was seen about noon at my request by Dr. Browning, who leaned toward a diagnosis of cerebral abscess rather than meningitis, but advised waiting a day or two for more definite data as to localization.

For January 13th, the bedside record is "that he slept at intervals, temperature lower, unable to keep patient in bed, left ear seems tender to touch. Urine scanty, oz. XXVII in 24 hours." Temperature variation from  $102.4^{\circ}$  in the morning down to  $100.6^{\circ}$  at midnight. Pulse, 76 to 100.

For January 14th, it is noted that "he slept all night, dozed at intervals through the day, slight reddish discharge from the left ear, takes nourishment better, tongue heavily coated, urine oz. XXII in 24 hours." Temperature at 4 a. m.,  $100.6^{\circ}$ ; noon,  $99.5^{\circ}$ ; then rose steadily until at midnight it was  $104^{\circ}$ , the pulse remaining from 80 to 100. The following morning, January 15th, at 4 a. m., the temperature was  $104^{\circ}$ , but dropped by noon to  $100^{\circ}$ .

The eye-grounds were examined on January 12th and showed a neuroretinitis of both eyes, slightly more marked in the left, indicating a general increase of intracranial pressure. Urine examination was negative. Blood examination showed 18,500 leucocytes, with a polymorphonuclear percentage of 81.5%.

Operation was undertaken January 15th, at 1:30 p. m. The left mastoid was opened, and some granulations and soft bone were curetted from the antrum; the incision was carried upward, and a large area of dura exposed with the rongeur; upon entering the dura, the pia was found to be intensely congested, and well forward, over the anterior temporal convolutions, was found a large area of exudate held within the meshes of the pia; some of this exudate was removed, and from it there developed the pneumococcus in pure culture. The underlying structures were investigated for any localized collection of pus, but none was found. The patient died about 48 hours later.

In the meantime the patient had been increasingly difficult of restraint, the temperature had gradually risen to 105.5°, and the left side of the face became swollen, the tongue became thick and was drawn (or pushed) toward the right.

About eight hours after death an autopsy was performed by Dr. Murray. A discolored, softened area of bone was found in the roof of the antrum, which was presumably the path of the infection. The base of the middle lobe on the left side was covered with an exudate similar in appearance to that found at the site of the operation, and another similar large patch covered a considerable portion of the parietal lobes on the right side. There was no abscess anywhere, and the exudate spoken of was nowhere of such a consistency as to be characterized as liquid pus, nor is it conceivable to my mind that material of this kind is in the slightest degree likely to make its escape through any such opening in the dura as has heretofore been recommended for the relief of this class of cases.

CASE 3.—Peter H., aged 24, a deckhand, was admitted to the Long Island College Hospital, January 29, 1910. There was a history of pain in the right ear three weeks ago, followed after about two days by discharge. He had suffered somewhat from dizziness, but had walked a considerable distance to and from his work until the day before he entered the hospital. On the same day he seems to have developed a facial paralysis.

He was admitted to the hospital late in the evening of January 29th, with a temperature of 105°, was unconscious, the neck was rigid, the limbs also were flexed and rigid.

On January 30th I saw him about noon, Dr. Browning about 4 p. m.; facial paralysis was marked, neck and limbs rigid, some indistinct evidence of mastoid tenderness; there was pus coming through a seemingly sufficient opening in the tympanic membrane; no sagging of canal wall.

A spinal puncture was made, and about 1 oz. of turbid spinal fluid was withdrawn; was entirely irrational; involuntary urination. There was a leucocytosis of 25,000 and a polymorphonuclear percentage of 85.

Urine examination showed some albumin present, and casts taking on a granular form.

Dr. Browning and I concurred in the diagnosis of menin-



gitis, and we both felt that the evidences of its general fulminating character were so unmistakable as to make an operation at that time an entirely hopeless undertaking.

Temperature at 4 a. m.,  $102^{\circ}$ ; 8 a. m.,  $103.6^{\circ}$ ; 12 m.,  $104^{\circ}$ ; 4 p. m.,  $105^{\circ}$ ; 8 p. m.,  $104^{\circ}$ ; midnight,  $103.5^{\circ}$ , with a pulse ranging from 82 to 108.

January 31st, still unconscious, very restless and noisy, urination involuntary. Takes no nourishment. Temperature,  $103.5^{\circ}$  at 4 a. m. down to  $100.4^{\circ}$  at 4 p. m. and up to  $102^{\circ}$  during the evening, with a pulse varying from 80 to 100.

February 1st, very restless and noisy most of the night, still urinates involuntarily. Spoke a few distinct sentences in the morning, becoming more rational as the day advanced, and began taking nourishment. Temperature at 4 a. m.  $101^{\circ}$  and slowly fell to  $98.6^{\circ}$  by midnight, with a pulse from 80 to 90.

From this time there is nothing very worthy of note except that the patient's condition improved from day to day. For a week complained of severe pain in the left side of head—he developed a boil in the external canal.

By February 14th he was so far convalescent as to be up and about the ward; temperature and pulse were normal, headache virtually gone. February 12th, a blood examination showed 20,000 leucocytes and 81% of polymorphonuclears; mastoid symptoms gone, tympanic membrane healed and hearing returning. There was no growth from the spinal fluid.

This case would seem to me to be somewhat of an upset either to our ideas of diagnosis or to those of prognosis of otitic meningitis; either we cannot be certain of a diagnosis of meningitis in the presence of practically all its recognized symptoms, even including that of an opaque spinal fluid, which I have heretofore looked upon as final and conclusive, or else we must modify our ideas of prognosis and admit that an occasional case may recover even without operative interference; and if we choose this latter horn of the dilemma, then may the question not be asked with some show of justification, "How many of the reported recoveries after operation might have recovered if left alone?"

Another question arises in my mind as perhaps worthy of our consideration, as a result of the findings in cases Nos. 1 and 2 of this series, and of observation in other cases on the operating and autopsy tables: Are there not two kinds of



otitic suppurative meningitis? One class in which fluid pus is found within the dura and in which drainage offers some hope of cure, and another class in which the pus, or exudate, is held suspended within the meshes of the arachnoid or pia, and in which drainage offers but little or no prospect of relief?

Are they two distinct processes, or only different stages of the same process? If different processes, does one present a possibly better prognosis than the other? And if so, can we attach to each a sufficiently distinctive combination of symptoms to enable us to determine beforehand in which cases operation may or may not be wisely undertaken?

130 Montague Street.

XLV.

VINCENT'S ANGINA INVOLVING THE LARYNX  
EXCLUSIVELY.

BY H. ARROWSMITH, M. D.,

BROOKLYN.

My purpose in presenting this report is to put on record a case which seems to be unique in the history of this disease. The bacteriology, pathology, symptomatology, diagnosis and treatment of Vincent's angina having been hitherto so exhaustively covered by various writers, will be entirely omitted.

J. N., male, 26½ years of age, U. S., married, a stableman, formerly a U. S. naval apprentice, came to my clinic at the Brooklyn Eye and Ear Hospital on August 27, 1909. During the previous week he had experienced a deep-seated sensation of discomfort in the throat, with gradually increasing hoarseness and dyspnea, which latter was pronounced at the time of his admission. His family history was negative. In 1899 he had pneumonia and gave a vague history of an attack of beri-beri lasting two months, while he was in the navy in the Pacific. He has been a very moderate user of alcohol, a smoker and denies any venereal infection. He has had occasional slight sore throat. Physical examination of the thorax was negative, pulse and temperature normal, respiration decidedly embarrassed. There was slight swelling of the neck externally. Laryngoscopy showed edematous swelling of the epiglottis, arytenoids and ventricular bands, and as his condition seemed serious, he was sent to the wards for observation.

His urine contained a trace of albumin and a small amount of sugar and microscopically a few granular and hyaline casts. He was passing about fifty ounces a day.

About twenty-four hours after admission to the hospital his dyspnea became so urgent that the house surgeon was obliged to do a hurried tracheotomy. This entirely relieved

the laryngeal symptoms; the tube was removed after four days, and the tracheal wound was completely healed by the third week. There was nothing of moment in the laryngoscopic picture, beyond a slight tumefaction of the epiglottis and the ventricular bands. His voice had recovered its usual tone and the discomfort and dyspnea were completely relieved. He was discharged, but returned on October 4th, with recurrence of hoarseness, dyspnea and swelling of the soft tissues of the neck.

The skin incision had reopened and was discharging very foul smelling pus, which had collected in the peritracheal soft parts and could be pressed out in considerable quantity. Several small abscesses were incised, and quite an amount of pus was liberated. No communication with the interior of the trachea could be discovered. The pus from these suppurating tracts was found to contain immense numbers of fusiform bacilli and spirilla of Vincent. Most unfortunately, owing to a misunderstanding, the sputum was not examined at this time, so that it is uncertain whether or not these bacteria were then present in the laryngeal and tracheal secretions.

On October 10th his dyspnea demanded a second tracheotomy, and smears from the interior of the trachea showed almost a pure culture of the specific germs, as did also sputum obtained by coughing. A blood count showed a moderate anemia—hemoglobin 68%, erythrocytes 3,867,000 and some leucocytosis—17,400. Urinalysis: A trace of albumin, no sugar, indican in excess, a few casts.

The tracheal secretions were extremely offensive and very viscid, necessitating frequent cleaning and removal of the canula. The odor persisted for weeks. During the ensuing six weeks frequent examinations of the sputum, tracheal secretions and granulation tissue from the tracheal wound showed almost pure cultures of the spirillum and fusiform bacillus, at times mixed with pneumococci, staphylococci and streptococci.

As his symptoms showed no amelioration and practically no air passed through the larynx when the tracheotomy tube was closed, on November 5th, I did a thyrotomy and inserted a Jackson's laryngostomy tube for the purpose of keeping the larynx open for topical applications and with the hope of averting future deforming cicatrization. When the larynx

was split I removed a mass of friable, cheesy exudate, which teemed with the specific germs. Beneath this exudate the mucous membrane was eroded and bled easily, and in spots the bare cartilage could be felt. The laryngofissure made the local treatment of the interior of the larynx and the trachea very easy and satisfactory.

The patient received a thorough antisyphilitic course of medication without benefit, and at my request Dr. Archibald Murray made a Wassermann test after the Noguchi method with absolutely negative results, thus presumptively eliminating syphilis as a factor.

At this point, on account of personal illness, I was unable to see the patient for several weeks, and for some reason, which has never been made clear, the laryngostomy tube was removed and the ordinary tracheotomy tube reinserted on November 19th. When I saw him again the thyrotomy wound had closed, down to the tracheal opening. About December 1st the patient had almost complete suppression of urine—albumin was 30% by bulk, no sugar, urea greatly diminished, casts of all descriptions, renal and vesical epithelium and free blood. For several days he had decided symptoms of uremic poisoning, and since that time has had several less severe recrudescences of his kidney symptoms. An examination on April 14th showed: Specific gravity 1012, albumin 10% by bulk, urea 1%, indican excessive, hyaline, granular, fatty, epithelial and blood casts, free blood and leucocytes.

By the middle of December the fusiform bacilli and spirilla had practically disappeared from the sputum and secretions, and cicatricial contraction had produced marked stenosis of the larynx. The patient has since been unable to breathe at all adequately through the larynx with the tracheal tube closed, but can phonate in very raucous and inharmonious tones. For more than a month daily attempts were made to dilate the larynx with Schroetter's tubes, but it has never been possible to introduce the fourth tube in the ascending scale, and as there was no apparent improvement the attempt has been abandoned. The larynx will now admit a fair-sized goose quill, but its structures are thickened and rigid.

Owing to the condition of the kidneys, I have not thought it justifiable to subject him to further operative attacks, as



he is fairly comfortable generally and perfectly so as far as his ability to breathe is concerned.

The temperature throughout his illness has been practically normal, the highest point,  $100 \frac{3}{5}$ , being just prior to the evacuation of the pus in the neck. At no time was there any oral or pharyngeal evidence of the specific lesion in question nor any involvement of the adjacent lymphatic glands, which has been a prominent and distressing symptom in the other cases of Vincent's angina that I have seen.

It would have been most interesting to determine whether the primary seat of infection had been within the larynx or tachea, or in the peritracheal areolar tissue. I have not been able to find in the literature that the spirillum and the fusiform bacillus have ever been identified in pus from abscess cavities or sinuses.

As complementary to the foregoing, the history of a recent case is of interest:

C. S., aged 41, male, U. S., a tutor, came to my clinic on April 20, 1910. Since October, 1909, he has suffered from gradually increasing hoarseness and dysphagia, which latter has become greatly aggravated during the past three weeks, so that now he is able to swallow fluids with the greatest difficulty. Coincidentally with the increase of his dysphagia a painful swelling of the submaxillary glands of the right side made its appearance. Since the commencement of his illness he has progressively emaciated and has had more or less cough.

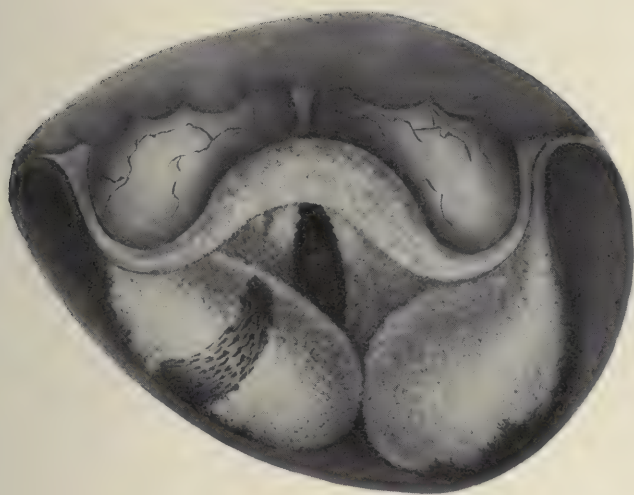
Laryngoscopic examination showed so much swelling and distortion of the supraglottic structures that the vocal bands could not be seen. The laryngeal surface of the epiglottis, the arytenoids and the ventricular bands were covered by a thick, dirty, whitish exudate, and my first thought was of extensive malignant disease with sloughing. Part of this exudate was scraped off, revealing a bleeding surface beneath. Physical examination of the chest showed infiltration of the right lower lobe, bronchovesicular respiration and some moist rales.

Dr. B. F. Cline, our pathologist, reported immediately as follows: "The exudate from the throat of C. S. shows numerous fusiform bacilli and spirilla of Vincent, with occasional streptococci and staphylococci. The sputum shows occasional tubercle bacilli."

The implantation of an infection of this kind on a pre-existing laryngeal tuberculosis is also, I believe, hitherto unrecorded. No exudate was discoverable elsewhere than in the larynx. Presumptively the intense aggravation of the pain, dating from three weeks before he consulted us, as well as the glandular involvement, marked the onset of the infection by the specific germs.

He has not returned since the first visit.

170 Clinton Street.







## XLVI.

### A CASE OF TYMPANIC VERTIGO.

By J. E. SHEPPARD, M. D.,

BROOKLYN.

Miss M., aged 26, first consulted me September 29, 1909, upon the recommendation of Dr. Frederick C. Eastmann.

She stated that for two years she had been treated by several specialists in Brooklyn and New York, and that a diagnosis of Meniere's disease had been repeatedly made.

*Previous History.*—Over two years ago she had a moderate attack of dizziness, and three or four months later began to grow dull of hearing in the left ear, the deafness having since then steadily, though slowly, increased. About six months after the first attack of vertigo she had a second attack, followed by another two or three months later. These attacks have increased in frequency and severity until now she averages four or five attacks daily; often wakes up dizzy during the night; on two occasions has fallen (both times backward); has never lost consciousness, but usually feels drowsy after and sometimes before the attacks; has frequently vomited during the attacks; some time after the trouble began constant tinnitus was added to the other symptoms, but does not seem to have been especially worse during or after the attacks of vertigo. Two or three times a month she has rather severe headaches, mostly frontal, and not apparently connected with the dizzy attacks. No evidence of stomach, bowel or uterine trouble. She wore glasses when at school, but gave up their use nearly ten years ago.

*Tuning Fork Tests.*—From midline, vertex and teeth, both C and C<sup>11</sup> forks were heard better in the unaffected ear. The absolute duration and relative intensity tests, I would say, indicated "mixed," middle and internal ear disease of only moderate severity, certainly not a pure labyrinth lesion. Watch, 8"/72". Speech and whisper, 20 feet. The tympanic mem-

brane was moderately retracted and opaque, with a rather small light reflex.

On using Siegel's otoscope the membrane moved freely, excepting only the manubrium mallei, which remained quite stationary, and on rarefying the air in the canal some dizziness was caused. The eustachian tube was shown by the catheter and diagnostic tube to be perfectly free and dry.

In the nose the following abnormal conditions were found: The septal cartilage, high up, was either split or covered with a greatly thickened mucosa, probably the former, so that there was some pressure between it and the right middle turbinate. The left middle turbinate cystic, probably the remains of an old ethmoiditis.

In the nasopharynx was found a rather thick adenoid pad, scarcely enough, however, to be obstructive to nasal breathing.

I recommended to Dr. Eastmann that, first of all, on account of the frequent headaches and the former use of glasses, the eyes be eliminated as a probable source of the vertigo, and they were accordingly examined by Dr. Edward Wright, who reported astigmatism of both, but more of the left, and ordered glasses, which were worn two or three weeks with seeming relief of the headaches, but with absolutely no effect on the vertigo.

Consequently on October 19th, I advised as the next step in our process of elimination, and this recommendation was made solely because of the above-mentioned immobility of the malleus handle, as shown by Siegel's otoscope, that a link be removed from the chain of ossicles, and the incus was at once removed in the office under cocain anesthesia.

On November 18th, one month later, I made the following note: "After the first day or two of slight upset following the operation, and as long as the opening remained in the tympanic membrane, the patient was entirely free from vertigo and was able to go out and about with more assurance than at any time during the past year." During the next few days after the membrane healed, and this I am at a loss to explain, she had a few mild attacks of vertigo, and I was just on the point of recommending as the next procedure that the adenoid pad be removed, when the vertigo ceased and she has had no further attack from that time to the present.

The tinnitus remains unchanged, and there has been a moderate increase of the deafness.

That this case should never have been classed as one of Meniere's disease, properly so-called, will, I think, be readily admitted by all of us, both from the character of the attacks, if carefully analyzed, and from the tuning-fork tests.

But I am not so sure of my ground when I endeavor to trace the connection between the immobility of the hammer handle and the interference with equilibration. My reasoning was that along with, and probably on account of, this immobility in the outer part of the chain, it was perhaps fair to assume that the foot-plate of the stapes was more or less firmly pressed into its niche in the oval window in such a way as to interfere with the tension of the intralabyrinthine fluid, through a disturbance of the compensatory provision of the membranes of the round and oval windows spoken of by Dr. Blake in his paper, read last week before the American Laryngological, Rhinological and Otological Society.

130 Montague Street.

## XLVII.

### ACUTE INFECTION OF THE LARYNX, DIAGNOSIS AND TREATMENT.\*

By F. E. HOPKINS, M. D.,

SPRINGFIELD, MASS.

Acute infection of the larynx, while not imperiling life, except, perhaps, in the phlegmonous variety, is yet freighted with possibilities of disaster to both patient and physician: To the patient because of the distress, apprehension and risk to function involved in the process, the possibility of damage to function being a reality, even to the average person, while to singers and public speakers it assumes a measure of great importance. To the physician there is the hazard to reputation if he do nothing, and an equal hazard if he do nothing effective or if his prognosis prove sadly erroneous.

The presentation of the subject of acute infection of the larynx has always lacked the definiteness and precision which it is possible to give to descriptions of like processes occurring in neighboring regions. This indefiniteness may be due in part to the lack of independent bacteriologic study of diseases of the larynx; and in part to the persistence in functional activity which so often prevails, whatever the stage or degree of inflammation.

Laryngeal diphtheria and tubercular infection of the larynx are exceptions to the foregoing general statement, and it is not proposed to consider either of them at this time, because of the degree of definiteness already attained in their handling.

Treatment, too, is empirical. A mild case even under treatment may persist for a long time if the patient insists upon use of the voice, since functional activity aggravates the laryngitis and favors the continued bacterial inflammation, or a severe case involving distress, cough and hoarseness may

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\*Written for the 1910 meeting of the American Laryngological Association.



make steady improvement with little care beyond absolute functional rest and intelligent regard for surroundings. Hence the value of treatment has been made to appear an uncertain quantity.

Now if a bacteriologist, moved by a desire to add to the sum of medical knowledge—and incidentally secure for himself the satisfaction of investigating a region as yet comparatively virgin—were to study infections of the larynx, he might be able to gain information which would lead to greater exactness in treatment, and shorten in good measure the course of acute infectious laryngitis. In the event of his success he would know that he had accomplished a definite advance, which is itself a generous reward. Patients might be only subconsciously grateful to him, and laryngologists might take to themselves much credit for following out the effective measures his study had indicated, yet the main reward would still be his.

As a matter of fact, the one real excuse for the appearance of this paper upon the program is to call attention anew to the need of independent bacteriologic study of diseases of the larynx, and if it may serve to direct the attention of bacteriologists to this need it will have accomplished a good purpose.

Primary infection of the larynx may occur in such grave disorders as diphtheria, tuberculosis, and phlegmon, as well as in the milder infections of influenza, etc., yet it is so constantly associated with or secondary to affections of the nose and pharynx that clinically the entire upper air tract must be included in the consideration of every case. The acceptance of the germ theory, and the explanation of inflammations of the respiratory passages as due to one, or another, or a combination of infections, cannot well be made more striking than by giving the etiology of acute laryngitis, from two of the older text books whose authors, in erudition and clinical experience, deservedly rank among the foremost laryngologists.

"We are generally taught that a sore throat or an acute laryngitis is the result of an exposure to cold, and this undoubtedly is the immediate exciting cause of the attack in the large majority of instances, but underlying this, I think, almost invariably, we shall find that there exists a mild chronic inflammation of the mucous membrane of the larynx, which, under the influence of an exposure, takes on an acute exacer-

bation. In other words, given the chronic inflammation, recurrent attacks of the acute inflammation become a prominent symptom. This point I regard as a somewhat important one, furthermore, I am disposed to think that an inflammatory process in the larynx is very rarely, if ever, a primary affection, but is secondary to an inflammatory process involving some portion of the air tract above. This is either an obstructive lesion of the nasal cavity proper, or some morbid process in the nasopharynx." (Bosworth.)

"It is generally stated that the exciting causes of a catarrhal laryngitis are similar to those which lead to the edematous form, only that they are modified by the intensity of the factor, or by action on a system less receptive of the baneful influence. Successive authors, following their predecessors, have taken no trouble to ascertain whether the nature of the "cold catching" or catarrhal factor, has any influence on the character of the resulting inflammation; and we thus find the same atmospheric and hygienic causes ascribed indiscriminately as predisponents or excitants of every variety of laryngitis.

First in importance amongst the causes of mucous laryngitis are the atmospheric, the principal of which is the inspiration of moist cold air, especially by those who habitually breathe through the mouth, or in the subjects of temporary nasal stenosis. Gottstein considers that 'no mucous membrane,' except that lining the nose, is so prone to inflammation, as a result of climatic influences, as that of the larynx." (Browne.)

Practically the same opinions are held to-day—accepting lowered resistance, local and general, in place of the chronic inflammation quoted; and regarding the constant or accidental presence of a variety of bacteria in the nose and throat as causative of the particular acute attack.

Within the limits of this title, only the infective forms of laryngitis may be considered, and while this covers a long list of cases, those are necessarily excluded which are due to traumatism—so to speak—as over-use or wrong use of the voice, or such as may be caused by the inhalation of irritating vapors or gases, as chlorine, ammonia, sulphur, or a smoke-laden atmosphere.

Since the direct etiology is implied in my title, only the pre-

disposing or contributing causes call for enumeration. These causes are local and general. Every text book takes up this branch in detail; moreover, this society does not stand in need of instruction in such elementary items, yet for a reasonably symmetrical presentation of the subject it is necessary to pass these contributing causes briefly in review, because of their importance and because of their necessary inclusion in treatment.

#### CONTRIBUTING CAUSES.

First among such are diseases and abnormalities of the nose and pharynx, such as the obstructive lesions which compel mouth breathing, and those attended by a discharge of mucus or mucopus, as postnasal catarrh and sinusitis with its drainage of pus upon and into the larynx.

Systemic causes, resulting in lowered vitality, which means diminished resistance. Under this heading are included some diseases in which are combined a local and general infection, as in the laryngitis of typhoid fever, measles, scarlatina, diphtheria, variola, etc.

Occupational causes, illustrations of which are to be found in street criers, trainmen, especially guards and brakemen who call out the stations, and to be included are also singers who must keep professional engagements when the larynx is not fit for functional activity. These, in reality, are all cases of chronic inflammation cited as predisposing cause by the early writer quoted, since the persistent use of the voice under such conditions induces congestion of the mucous membrane of the larynx and favors infection.

Among those whose occupation exposes them to especial risk of infection are the nurses and attendants of patients suffering from contagious diseases, and these people ought always to be advised of measures they may take for protection.

#### DIAGNOSIS.

Had this branch of the subject reached the measure of definiteness to which we hope it will yet attain, the first and principal item in diagnosis would be its determination by a bacteriologic examination. In fact, this solution is implied in the title, for given an infective inflammation the determination of the causative bacteria should at once lead to intelligent ap-



plication of means to a cure. Even now bacteriologic examinations are employed, yet the plan is applied with reference to the whole upper tract oftener than to the larynx.

Whatever perfection bacteriology of the larynx may reach, we must yet examine with the same care as ever for the stage and degree of inflammation, the area involved, the destruction wrought by necrosis, etc.

The trained observer will often reach a measure of accuracy as to the character of the diseased process, from the sound of the voice, as is so often instanced in tertiary syphilitic lesions of the larynx. He will also distinguish differences due to swelling within the larynx or involving the cords, also such as are due to muscular pareses. All this is but saying that every aid, whether of bacteriology, laryngoscopy or trained observation of eye or ear, is brought to the aid of diagnosis.

The diagnosis in a given case becomes the determination of the existence of an acute laryngitis, whereupon bacteriology is called upon to differentiate the particular bacteria causing the inflammatory process. In the average case, usually due to pneumococci, streptococci, staphylococci or Pfeiffer's bacillus or a variegated combination of these, the determination of the existence of such bacteria is sufficient, a differentiation not being at present of therapeutic significance, since the agents at our command for the destruction of the invading hosts are but limited. We are thus obliged to use much the same local applications, whatever the bacteriologic findings, but prognosis is made more intelligent if we may know the particular exciting agent of an inflammatory process, while continued investigation of causes will bring progress in treatment.

In the laryngitis of the exanthemata, the history of an epidemic, the examination of the patient or the bacteriologic findings will suffice to fix the diagnosis. In the laryngitis of typhoid fever, too, there are usually the same collateral aids to diagnosis, since the serious lesions of edema or ulceration do not occur until as late as the second week.

Tubercular laryngitis affords a wide range of appearances from the pretubercular congestion, through the various phases leading to edema and destructive ulceration, yet the picture presented by the general disease is so well known and the microscope is so early called in aid, that diagnosis is not likely to remain in doubt. The same may be said of the erythema and superficial ulceration of secondary syphilitic lesions, and



it is more true of the indurations and deep ulcerations of the tertiary stage. Bacteriology may not here offer assistance, these lesions being dependent upon the constitutional infection, though respectful hearing will be granted our bacteriologic knight-errant who will undertake to tell us of all the elements entering into this particular necrotic process.

The grave infections of erysipelas and phlegmon are not mentioned in this hasty sketch, for it is well understood by such an audience that the mild local measures to be advocated under the head of treatment, could at best but be prophylactic with reference to these disorders.

Treatment may well be considered under the divisions of prophylactic, local and general, naming them in order of their importance.

Prophylactic is properly placed first, since if the nose, nasopharynx and pharynx could be kept of normal capacity and even approximately free from bacteria, infection of the larynx would be rare indeed. Much evidence is accumulated to the effect that all air-borne diseases find their entrance to the system through the portals of the nasopharynx and pharynx. How important, then, to make difficult the lodgment here of cocci of any sort. Strictly speaking, under the head of prophylaxis would fall the consideration of all the obstructive lesions of the nose and throat, and the care of every mucopurulent process, including sinusitis; but a simpler suggestion is in mind.

Speaking first of those especially exposed to the risk of contagion, as nurses and attendants upon those suffering from contagious and infectious diseases, free use many times a day should be made of mild alkaline and antiseptic solutions—such as Seilers'—by means of spray, douche and gargle, or a more active antiseptic agent, such as that recommended by Pierce:

R. Acidi salicylici .....	dr. x.
Spts. aetheris nitrosi.....	
Alcohol .....	aa oz. j
Formalin.....	(1-10) oz. ss. to oz. j
Ol. carophil .....	dr. j
Glycerin .....	q. s. oz. x.

M. Sig.—A half teaspoonful of this to half glass hot water is to be used as a gargle and mouth wash.

In addition to attention to such matters of local hygiene, the highest measure of resistance should be cultivated by exercise, fresh air and good food. Germs we have with us always—keep them away and the doors locked, so far as may be.

For use in the nose and throat we are compelled to employ solutions of but mild germicidal power, yet there is no doubting the efficacy of their free use as suggested; and this should be insisted upon for those especially exposed.

The direct treatment becomes that of caring for the acute laryngitis, and this demands first of all absolute abstention from the use of the voice. Rest in bed in a room the temperature of which is maintained at about 70. The inhalation of steam impregnated with comp. tinct. benzoin, the taking of hot drinks, the use of calomel in divided doses, to be followed by a saline, the application to the throat of a compress wrung from cold water and covered with a flannel bandage, the employment of ice externally in the grave infections, as phlegmon, all contribute toward gaining prompt control of the acute process.

For its control of the circulation and its aid toward prompt recovery, I recommend with much confidence the following:

R. Atrophin sulph.....	gr. 1/700
Heroin .....	gr. 1/24
Caffein .....	gr. ¼
Pyramidon .....	gr. ij

M. et ft. Caps. No. 1. Sig.—Take one capsule every four hours.

Cold sprays thrown directly into the larynx are of much greater value than warm steam inhalations; and we should wander far from our title if effort were not made to influence a local infection by the direct application of some germicidal agent. It is true that we are much restricted, since no risk may be taken of injuring the patient through our efforts to destroy the bacteria.

Happily we have in argyrol an agent of proved clinical value and a nonpoisonous product. It is true that in the laboratory argyrol has not made a notable record as a germicide, yet much experience with its employment in ophthalmologic clinics has made for it enthusiastic advocates. It does not apparently blanch the tissues, yet practically it acts as an astringent;

though in the laboratory it is not a powerful germicide, applied to mucous membranes it has that effect, and that without causing local irritation.

We have need here that our bacteriologist prove himself a physiologic investigator as well as a learned laboratory expert, that he may give the scientific explanation of processes sufficiently satisfactory empirically, but as yet lacking accurate description.

The local treatment is, first the thorough cleansing of the surfaces with an alkaline spray, this to be followed by adrenalin to blanch the mucous membrane and reduce the congestion, then the application, also by means of a spray, of a solution of argyrol in strength of from 20 per cent to 40 per cent.

This is for general consideration—specific processes like those of diphtheria, tuberculosis, erysipelas, phlegmon and syphilis must have their appropriate treatment. Fortunately the great majority of cases, presenting themselves for care, fall into a list making them amenable to the treatment described, and the employment of this plan will give satisfaction to both patient and physician.

XLVIII.

HISTORY OF A CASE OF RECURRENT PAPILLOMA  
OF THE LARYNX, EXTENDING OVER THIRTY  
YEARS, DURING WHICH TWO THYROT-  
OMIES WERE PERFORMED.\*

BY FRANCIS R. PACKARD, M. D.,

PHILADELPHIA.

The patient whose case I report, has been kind enough to write me out a brief epitome of his history before coming to me, which tells the story so well that I have merely transcribed it.

"I was born in Birmingham, England, on September 1st, 1838. In 1880, being then occupied as an auctioneer, I noticed my voice beginning to get husky. In the spring of 1881 I caught a severe cold, due to getting soaking wet, and my voice rapidly failed me. I then sought medical advice, but getting no relief from one, consulted others with the same result. I found they were all treating me for syphilitic sore throat. I then, under the advice of Dr. Kenny of Birmingham, who had consulted Sir John Sawyer as to the nature of the trouble, came to Philadelphia, and went to the University Hospital. This was late in November, 1883. At the University of Pennsylvania I fell into the hands of Dr. John Sheets, of Philadelphia, who was then assistant to Dr. Seiler, who at once diagnosed my trouble as multipapilloma of the larynx. After many intralaryngeal operations by Dr. Seiler, and many more by Dr. Sheets, each of whom removed much growth, they both stated it returned as fast as it was removed. In April, 1884, I visited Bellevue Hospital, New York City, and attracted the notice of Dr. Seeler, of Newark, N. J., who performed very many operations with the forceps. I attended Dr. Seeler's office until late in September, when, by his advice,

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\*Read at the meeting of the American Laryngological Association, May, 1910.



I went to the New York Polyclinic Hospital, and became an outdoor patient. Dr. Gleitsmann took a special interest in me, and after a time he invited me to attend his private office, where for some months he tried his very best to clear my larynx. He tried everything then known to the medical profession, but although he removed an immense lot of papilloma it seemed to return again in twenty-four hours. At length, to save my life, he persuaded Dr. Gerster of New York City to perform a laryngotomy. The operation took place in July, 1885, and appeared to be a complete success, but in 1887 the growth reappeared. I consulted Dr. Gleitsmann, who succeeded in removing part of it, but the position the growth had taken defied all efforts to remove it. The operations performed by Dr. Gleitsmann, Dr. Lederman and Dr. Sheets carried me along until 1904, when I fell into your hands. The rest of this little story you know better than I do."

I first saw the patient on the 19th of October, 1904. He was then 66 years of age, and had had laryngeal trouble for twenty-four years. He was a strong, large, healthy-looking man. His voice was so husky that it was with difficulty that one could understand what he tried to articulate. His breathing was also laborious, with considerable inspiratory dyspnea. Upon examination, his larynx was found almost occluded by large papillomatous masses projecting into its lumen below the cords on both sides and from the anterior commissure. There were also small papillomatous masses upon both cords. At this time, and in a number of subsequent sittings, I removed pieces of the growth, but did not succeed in extirpating it, as it recurred with the most wonderful celerity.

In February, 1905, I took him to the Pennsylvania Hospital, where Dr. Le Conte divided the thyroid cartilage anteriorly and removed large masses presenting the typical appearance of papilloma. These were submitted to a microscopic examination, and the report was as follows:

"Specimen consists of a very small, somewhat dried, gray translucent piece of tissue.

*Microscopic Examination.*—Sections from small tumor of the larynx show it to be largely composed of a thick layer of squamous cell epithelium, resembling the thickened corium of the skin. Lying beneath this layer is a well-defined univaded layer of connective tissue. A small amount of blood is seen

lying outside the tumor mass. No inflammatory changes are seen. No signs of malignancy.

*Anatomic Diagnosis.*—Benign papilloma of the larynx.

He made a good recovery from the operation, and his respiration became practically normal. His voice continued somewhat husky, but he could be distinctly understood. From time to time since the operation I have seen him, and he has continued to remain in excellent condition, both generally and locally.

On April 12, 1910, when I last examined his larynx, it presented a small irregular projection in the anterior commissure, which I think is nothing but the scar or stump left by the removal of the growth in 1905. His vocal bands have the appearance of narrow, thick cords, and are a good deal reddened and thickened along their inner margins.

The interesting points in this case are:

1. The long time during which the patient has been under observation, and throughout which intelligent treatment has been directed towards the relief of his condition.
2. The fact that throughout that period, practically as far as can be known, there has been no change in the nature of the neoplasm.
3. The fact that this growth is so typical as to etiology, occurring in an auctioneer, as to progress and recurrence in spite of repeated removals, as to growth and microscopic appearance, and lastly, as showing no tendency, in spite of repeated operative interference and traumatism, to undergo any malignant degeneration.







## XLIX.

### A CASE OF SUBMAXILLARY ABSCESS CAUSED BY THE USE OF AN INFECTED TOOTHPICK.

BY CLARENCE PORTER JONES, M. D.,

NEWPORT NEWS.

Archer Davis, white, male, age 24 years, robust in health, with excellent family and personal history; a grocer by occupation. On March 12, 1908, he picked his teeth with a straw from a dirty floor broom. On dislodging something from between the second and third right upper molars the straw broke and wounded the anterior pillar. He went immediately to a physician in the neighborhood who, seeing a most insignificant wound, assured him there was no need for alarm, there being slight pain and hemorrhage. He kept on at his work for the present without incident. On the third day after using the straw toothpick he noticed a peculiar feeling hard to describe located under the jaw and in the neck on the right side. Upon stooping down, lying down or pressure on the neck, a marked slowing of respiration was noticed; no fever. This embarrassment of respiration increased till at the end of a week the recumbent position was impossible. There was no swelling or other abnormal appearance in the throat or neck, at this time. He kept about his place of business, getting on fairly well, provided he wore a loose collar, remain upright and avoid stooping.

On awaking April 8th, 27 days after the initial injury, he was unable to open his mouth wide; having the usual symptoms of peritonsillar abscess, temperature 102° F. per os. Also marked edema of the uvula. All efforts at swallowing, in addition to the pain caused, so seriously embarrassed respiration he was told to refrain from the same. Amputation of the uvula seemed to have no effect toward relieving the distressed breathing. Making numerous incisions in the region of usual attack on this day, repeated the following day,

demonstrated without doubt the complete absence of a peritonsillar abscess. The bloodletting incident to these incisions seemed to give much relief from pain and some relief from the respiratory symptoms. The temperature slowly declined to the normal.

On the 13th, or five days thereafter, he suffered very little pain, swelling about the pillar had nearly disappeared. Respiration at this time much better; in fact, he could lie down for a short time at hourly intervals, a privilege he had not enjoyed for over three weeks prior to this time.

On the 14th, or the next day, or better still, 33 days after the toothpick wound, I was hurriedly summoned to see him. I found him sitting quietly in a Morris chair, his facial expression and other symptoms were those of an acute attack of asthma, except the respiration was quiet and noiseless, being 12 per minute. Temperature  $100\frac{1}{4}^{\circ}$  F., per os., pulse 62. There was nothing abnormal to be seen in the throat or mouth except some swelling of the tongue. The nasal chambers were free. There was some swelling and fluctuation over the submaxillary region. Pressure over this region had the immediate effect of stopping respiration, which stoppage would not cease and breathing resume under half a minute.

He was taken to the Dixie Hospital, and preparations were at once begun for operation. At 1:30 o'clock, while the nurse was lightly scrubbing the jaw with a soft brush and a green soap solution, his breathing stopped, and in spite of all efforts, artificial respiration, lowered head, tongue traction, slapping chest with wet towel, etc., two and one-half minutes elapsed and patient seemed to be surely dead. Tickling the nasopharynx with a cotton sponge held in a pair of adenoid forceps caused the breathing to return (a point I gathered several years ago while administering anesthesia). As soon as breathing was fairly well established an incision was made through the skin down to the submaxillary gland, which was found to be broken down into a greenish pus of a horrible odor. The making of this incision caused another stoppage of respiration, the tongue being held forward by an assistant with a pair of forceps, was bitten so severely as to be more than half severed from a violent spasm of the jaw just at this juncture. After about a minute breathing was established by applying the same irritation to the nasopharynx, this time by means of

a cotton probe passed through the nose. A troublesome oozing hemorrhage ensued from the wounded tongue, which was checked by hot water. Strychnin and whiskey were given hypodermically, warmth to the extremities and continuously employing artificial respiration with an occasional tickling of the nasopharynx with the sponge held by curved forceps for the space of two hours, he could breathe ten times per minute without aid. The neck wound now being irrigated with hot saline solution, was packed with iodoform gauze. The packing caused another powerful spasm of the jaw, this time biting in two an old-fashioned hard rubber screw gag. Also a cessation of respiration for three minutes. Irritating the nasopharynx with a probe through the nose and slapping the chest with cold wet towels caused breathing to resume. Artificial respiration at intervals was practiced for two hours more, when he could breathe alone, respiration being 13 per minute. He regained consciousness at 6:30, being unconscious five hours. He was propped up in bed, a special nurse was put in charge, who watched his breathing closely, and at intervals of slow breathing tickled the nasopharynx with the sponge, held by curved forceps. It was four days before breathing was as much as 18 per minute. Temperature remained slightly subnormal during this time. A piece of the straw toothpick three-eighths of an inch long was found in the pus which came from the gland. Both wounds healed promptly and without incident. No anesthetic administered.

The case presents several points worthy of note:

1. There was undoubtedly a local neuritis of the vagus at some point below the superior cervical ganglion. The patient behaved as if the nerve was severed.
2. Spasm of the jaw due to irritation of the superior cervical ganglion, this ensuing even when the patient was in an unconscious state and in a state of profound depression.
3. Irritation applied to the nasopharynx re-established connection between the cortex and lungs, this temporarily mending the "wires," a point of value in treating shock from anesthesia.

I.

## THE RESPIRATORY AND VOCAL SYMPTOMS IN PAPILLOMATA OF THE LARYNX.

BY G. HUDSON-MAKUEN, M. D.,

PHILADELPHIA.

Papillomata of the larynx interfere with respiration and vocalization in two ways. First, they have an obstructive influence by diminishing the lumen of the larynx, and second, they interfere with the normal and delicate automatic action of the intrinsic musculature. The obstructive influence, as well as the influence arising from the interference with the muscle action, varies with the character and location of the tumors.

In order to appreciate fully the respiratory and vocal symptoms which arise from papillomata of the larynx, it may be well to recall for a moment some points with reference to the physiology of this organ. The problem, which nature seems to have solved so well, was to place the vocal bands within the respiratory tract in such a manner as not to encroach upon its lumen during ordinary respiration. This was done by the insertion of a group of muscles, whose automatic function it is to project themselves into that portion of the respiratory tract known as the larynx during phonation, and to modestly withdraw again during respiration.

In a sense, therefore, phonation may be regarded as an incident in respiration. It is, in fact, a modified or an elaborated form of respiration.

I have ventured elsewhere to define voice as a moving column of breath set in vibration by its own impact with the vocal bands and reinforced by its diffusion through the various resonance chambers into the surrounding atmosphere. If this definition be a correct one, it is evident that anything which interferes with respiration must also interfere with vocalization.

A feature of the larynx, which is often overlooked in study-



ing the physiology of voice, is its function as a resonator. The vibrations imparted to the moving column of breath during voice production extend in both directions from the vibratory bodies, and the infraglottic as well as the supraglottic space becomes resonant with voice. Moreover, that the trachea, bronchi and bronchial tubes also share in this function may be demonstrated by simple auscultation.

Another feature of the larynx, which should be mentioned in this connection, is what some physiologists (among whom Czermac, I think, was the first) have called its double valvular action. This may be made to appear both in inspiration and expiration. It is well known that when the edges of the true vocal bands are approximated, their superior surfaces on either side of the rimaglottidis are slightly concave, and an attempt at inhalation will tend to keep the bands closed and prevent the influx of air. This forms the inspiratory valvular action of the larynx.

Moreover, it has been shown that the ventricular bands may be adducted while the vocal bands are in the position of abduction, and that an attempted expiratory blast, such as is used in phonation, taking place during this abduction of the ventricular bands, will tend to inflate the ventricles on either side and thus mechanically hold the bands in apposition, and the stronger the expiratory effort the tighter will be the apposition. This is called the expiratory valvular action of the larynx, and it is made use of to explain the physiology of coughing and certain spasmodic phenomena giving rise to defects of voice and speech.

Keeping in mind the various functions of the larynx which I have mentioned, we shall be in a position to understand more fully the respiratory and vocal symptoms which arise from interference with these and other functions by papillomata of the larynx.

#### RESPIRATION.

The respiratory function of the larynx is not noticeably interfered with by papillomata until the lumen of the larynx is encroached upon by the large size, the shape or the position of the growths, and it is surprising oftentimes to what extent these tumors may grow without appearing to obstruct the breathing, so great is the adaptability of the parts. On the other hand, a very small tumor may be so situated as to se-

riously impede breathing when the patient has a cold and is obliged to cough, or during certain changes in the position of the body. It is in the reclining position that difficulties in respiration usually first appear.

The respiratory symptoms are of gradual onset, and they are not often observed until some time after the vocal symptoms are well established. As the tumor increases in size the breathing becomes more and more difficult, and we all know that labored respiration is the most serious of all the symptoms, calling sometimes for prompt surgical interference. Coughing and choking at night may usher in an attack of dyspnea and, as someone has said, a child will often rise up in bed and stretch out his arms as if pleading for breath. The mechanism of this alarming dyspnea may best be explained on the principle of the valvular action of the larynx to which I have referred. The act of coughing closes the valves, and the combined pressure of the breath and tumor keeps them closed. A freely movable cauliflower-like growth is thrust up into one or both ventricles already inflated by air pressure, and the patient is unable to dislodge it. The valves will not open to admit air and the child becomes cyanotic.

#### VOCALIZATION.

The first symptom of papillomata of the larynx is generally some interference with vocalization, and this interference may be of any grade, all the way from a slight hoarseness to complete aphonia. The vocal symptoms also begin insidiously, and their origin may be attributed to other less serious conditions, such as enlarged faucial or pharyngeal tonsils.

Papillomata of the larynx in very young children may interfere with the development of speech by rendering vocalization difficult or even impossible, and when they appear before the age of two or three years attempts at speech result in little more than a hoarse whisper. The hoarseness in papilloma of the larynx, although not characteristic, differs somewhat from that in other tumors of this organ, because papillomata are generally more movable, and they have their origin in the mucous membrane, while other tumors invade the muscles, cartilages and joints of the larynx. The hoarseness in papillomata of the larynx, like the difficult breathing, varies at times with the rapid variations in the size, position and mobility of

the tumors, and there is a distinct effort in attempts at phonation which I think is quite characteristic. The vocalization at times is but little more than a whisper, with a moist, whistling sound. The absence of pain is another feature which distinguishes papillomata from other diseases of the larynx, and fever is also rarely found. Other clinical symptoms of papillomata of the larynx, their etiology, pathology and treatment, although exceedingly interesting, do not properly come within the scope of this paper.

## LI.

### SOME TUNING FORK TESTS WITH A SPECIAL AUSCULTATION TUBE.\*

BY L. M. HUBBY, M. D.,

NEW YORK.

Barany has recently proposed a new method of making tuning fork tests. The examiner uses an auscultation tube the ends of which are snugly inserted in his own ear and the ear to be examined, while applying a sounding tuning fork to the mastoid process, to the auricle or to the auscultation tube with varying degrees of pressure, and comparing the intensity and duration of the notes as heard by the patient and the examiner. He claims the following advantages for the method:

1. Examination can be made in noisy surroundings.
2. Varying degrees of pressure of the tuning fork can not interfere. This is not true of the older methods of making the Rinné and Schwabach tests.
3. The exact point of application of the fork on the mastoid process is not of consequence. Of course, it is better to seek a point where there is maximum bone conduction when the tone is heard for only a short period by the patient.
4. Results are rapidly obtained.
5. Slightest impairment in air conduction is easily shown.
6. Diagnosis of internal ear involvement is possible when both middle and internal ear are diseased.
7. It is valuable in cases of simulation, as the examiner has constant control through his personal perception of the sounds.
8. Defective hearing of examiner is no obstacle, as the amount of this loss can be measured and due allowance made in the duration tests.

The following facts constitute the basis for the method:

1. The condition of the middle and internal ear of the patient is immaterial to the examiner during auscultation, wheth-

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\*Read before the Otological Section of the New York Academy of Medicine, April 8th, 1910.



er the sound of the tuning fork is conducted by the air, the cartilage or the bone.

2. A tuning fork applied to the mastoid process of a patient should be heard for an equal length of time and possibly a little longer by the patient than by the examiner during this auscultation.

3. Air, tube or cartilage conduction give approximately equal results except in a few instances.

Barany notes that in cases of small nonmarginal perforations of the ear drum the cartilage conduction is better than that through the tube.

Barany uses a tube supposedly the same length as that of the sound wave of a Politzer middle tuning fork pitched between d 576 V. and e 640 V.

His idea is that the intensity of the tone in the tube will then be equal at both ends, the tube acting as a resonator. This is impracticable for the following reasons:

1. Variations in temperature change the lengths of sound waves. Therefore tubes would have to be constructed for different temperatures.

2. The length of the external auditory canal and the depth at which the olivary bulb of tube can be inserted vary.

3. Changes in the rubber tubing due to stretching, etc., prevent any accurate permanent adjustment of the length of the air column.

4. It is desirable to use different forks. This would necessitate a tube for each fork. Moreover, in making application of the fork to the tube it would be necessary to apply it either at the end or exactly in the center, so as to be at the antinodes of the tone wave. I have therefore abandoned the idea of expecting the tube to act as a resonator.

I have found that if the combined air column in the tubes be, roughly speaking, less than a meter, that the bone conduction in a normal ear is markedly increased, but that for lengths greater than a meter the increase in bone conduction is very slight. It is therefore best to make the combined tubing a little over one meter.

The auscultation tube used by me consists of four rubber tubes joined together by a tubular cross, which permits free air communication between the four. The tube to the patient is one meter long and has a black olivary tip at one end for

insertion into the patient's ear. It is well to have several different sized tips to insure a good fit in exceptional ears. The tube to the examiner has a white olivary tip and is two-thirds of a meter in length. The third tube, 9 cm. long, goes to a 6 ounce valveless Politzer bag. This is used to test the proper insertion of the olivary plugs before proceeding to the fork tests, and for the compression and suction tests. The fourth tube, 9 cm. long, leads to an aneroid or mercurial manometer. In the ordinary tests it is detached from the manometer and closed with a thumb clamp. This thumb clamp can be placed on the tube to the examiner when it is wished to test the ear by compression and suction with the manometer alone. With a 6 ounce Politzer bag, compression or suction up to 40 mm. of mercury can be readily produced. It is generally useless to try to use higher pressures, as the olivary tips, even when well inserted, allow leakage at about 40 mm. of mercury pressure, unless held in place with the hand. The aneroid manometer attached to the Tycos sphygmomanometer is most convenient for the purpose.

I will now give you a short description of the tests.

#### AIR CONDUCTION TEST.

Insert olivary tips. Test whether these are tightly placed by gently pressing Politzer bag. If there is any leakage of air there is no movement of the examiner's drum, and the insertion of the tips must be corrected. Now apply a moderately sounding tuning fork to the mastoid process and then quickly to the auricle or to the auscultation tube, endeavoring to make the intensity of the tones as conveyed to your ear equal, by varying the degree of pressure of the fork at both places. If the patient under these conditions hears more intensely the tone by bone conduction there is impairment of air conduction. The test can be varied *ad infinitum*. Very slight impairment of air conduction can be demonstrated only with the lower tuning forks. When there is impairment of hearing and the result of the above test is negative, the internal ear, auditory nerve or centers must be the seat of the defect. The higher tuning forks, such as C<sup>4</sup> 2048V, cannot be used on the tube, as the amplitude of the vibrations in the fork handle is not sufficient to set up sufficient vibrations in the tube. In marked unilateral affections of the internal ear, errors may result,

according to Barany, due to the normal bone conduction of the healthy ear giving the patient the impression of a relatively increased bone conduction in the diseased ear. This can be corrected by testing for the lower tone limit.

Another test for internal ear deafness is to compare the length of time that a tuning fork applied to the mastoid process is heard by the patient and the examiner. Fatigue of the auditory nerve is avoided by applying the fork intermittently. Barany states that in combined involvement of the middle and internal ear, occasionally the presence of the tube tip will reduce the length of time of bone conduction. This can be discovered by removing the tip as the tone perception disappears and noting whether the tone returns to the patient.

By means of the auscultation tube method a more exact Schwabach set of figures can be adduced, if desired. For by this method you need not start the fork vibrating with such great care and precision, since you use only the latter vibrations. Of course errors may occur if the tuning forks are made to vibrate for too short a period of time. The figures can be expressed as — or + normal. Thus, hearing of patient for

C. 128 V. ( $\frac{36 \text{ A. C.}}{18 \text{ B. C.}}$ ) may be expressed  $\frac{-6 \text{ A. C.}}{+2 \text{ B. C.}}$  or  $\frac{30}{20}$

Compression and suction tests for ossicular mobility can be most satisfactorily performed with this tube. The tests can be done with the tuning fork applied to the mastoid process, as suggested by Gellé, or to this auscultation tube at a point approximately equidistant from the ears of the patient and examiner. It takes very slight pressure, 2 to 5 mm., to produce a decrease in the tone perception in a normal individual. By means of the manometer the degree of rigidity can be expressed in mm. of mercury, and you will be able to follow more accurately the progress of the ankylosis.

## LII.

### ABDUCENS PARALYSIS AND OTITIS MEDIA PURULENTA.\*

BY CHAS. E. PERKINS, M. D.,

NEW YORK.

Abducens paralysis as a complication of otitis media purulenta, while somewhat rare, is of sufficient importance to occupy our attention. I will, therefore, relate briefly the histories of six cases, three of which I have personally treated, and draw some conclusions from the study of ninety-five, which have thus far been reported.

The first two cases were treated by me in Dr. Dench's service at the New York Eye and Ear Infirmary.

C. E., male, age 54, came into the hospital in June, 1908, with acute otitis media and mastoiditis on the left side, for which an operation was performed with normal recovery, except continuance of ear discharge. Early in November, 1908, following some intranasal operation, the right ear became affected and had been discharging several days when I saw him on November 13th. He had been suffering with a very severe pain in his head, especially marked in the frontal region and in the eye. The posteriosuperior wall of auditory canal was sagging somewhat. There was a small perforation in the membrana tympani. The discharge was very profuse. There was total absence of mastoid tenderness. Myringotomy performed. Slight improvement in the pain. On the 17th he had developed diplopia, and upon examination it was found that the patient could not abduct the right eye, but upon attempting to fix to the right, the left eye followed the finger, while the right stopped in the median position. Dr. Percy Fridenberg examined his eyes on the 18th and found the eye-grounds normal and diagnosed paralysis of the sixth nerve on right side.



Even in the absence of mastoid tenderness it was deemed best to operate, narrowing of the canal, the presence of great pain, the profuse discharge, and the possibility that the drainage was notwithstanding incomplete, determining this decision. So I performed the mastoid operation on the 18th of November and found a pneumatic bone, the cells congested, the antrum deeply placed, and bone in its vicinity softened and contained pus under some pressure. Dura in middle fossa, intentionally exposed, was apparently normal. There was complete relief from pain immediately after the operation. In four weeks, the first improvement in the paralysis was noticed, and recovery was complete in a little less than three months.

CASE 2.—William H., age 66, cabinet-maker, admitted to the New York Eye and Ear Infirmary, June 7th, 1909, gave history that about three months previously, following a cold, he suffered with pain in the right ear, which shortly thereafter began to discharge a yellow pus. The pain ceased in one week, but the discharge continued profuse for some time; then became scanty, accompanied by a severe pain in the ear and a dull headache on the whole right side. Patient had a subperiosteal abscess, and several days before coming to the hospital had noticed that he had diplopia when looking towards the right, which on examination was found to be due to paresis of the external rectus of right eye.

Mastoid operation showed subperiosteal abscess, perisinous abscess extending very deeply on the posterior surface of the petrous portion, from which location large quantities of pus welled up. Bacteriologic examination showed infection to be *streptococcus capsulatus*.

The horizontal semicircular canal was exposed and found to be normal in appearance. Recovery uneventful. The paresis of the abducens was found to be absent on the second day after operation, and there was no more diplopia. Eyes continued normal.

CASE 3.—Frank W., colored, age 33, came under my care in the New York Polyclinic Medical School and Hospital, on January 5th, 1910, with acute suppuration of the left ear, from which he had been suffering about ten days. There had been spontaneous rupture of the membrana tympani. The discharge was quite profuse. There was some pain in the ear

and a severe headache over the whole left side. He was put upon bichlorid irrigation. On January 9th he first noticed diplopia. I examined him on the 12th and found complete paralysis of the sixth nerve on the left side—the left eye could not be rotated beyond median position. Eyegrounds were normal. Absence of mastoid tenderness. Fundus of auditory canal narrowed. Discharge profuse. Hemicrania persisted. Admitted to the hospital and operation performed on January 15th.

I found the cortex very thick, the mastoid cellular congested and full of granulations. The antrum was situated deeply, and in its neighborhood the bone was much softened, a considerable quantity of pus under apparent tension welled up when this region was opened. The dura in the middle fossa was exposed over quite an area and seemed to present no great departure from normal condition.

Convalescence uneventful. The paralysis showed some improvement in two weeks, then remained stationary for one month, since which time it has improved rapidly until now, March 23d, movement of the eyeballs are normal and recovery complete.

The following cases occurred in the practice of Dr. Alfred Wiener of this city, and it is through his courtesy that I am able to report them.

CASE 4.—Male, age 60, had acute otitis media of influenzal origin, myringotomy done on second day. Patient had severe headache on involved side—was not, however, localized in any special region. There was also vomiting. In the third week of the disease, paralysis of the sixth nerve with diplopia occurred. The eyegrounds were normal. Mastoid operation, performed soon after the appearance of the paralysis, revealed extensive disease of the bone, with much pus. Bacteriologic examination showed infection to be streptococcus capsulatus. Mastoid wound healed in about three months and abducens paralysis disappeared at the same time.

CASE 5.—Male, age 52, acute otitis media with myringotomy on second day, followed by profuse discharge. Frontal and parietal pains of great severity. Abducens paralysis occurred in the third week, followed on succeeding day by herpes in auricular region of the same side—eyegrounds normal. Mastoid operation showed diseased bone and an epidural abscess

in the middle fossa. Pus contained staphylococci. Abducens paralysis improved slowly, and it was about six months before recovery was complete.

CASE 6.—This case is one that was treated by Dr. S. J. Kopetsky, and I report it from notes kindly furnished by him. Male, aged 32, had acute otitis media, following influenza with involvement of the maxillary antrum. Myringotomy was performed early. There were very severe pains in the frontal and parietal regions. Diplopia due to paresis of the external rectus developed about the fifth day. The mastoid was tender on pressure, and the external auditory canal narrowed at the fundus. Operation demonstrated that the bone was cellular and much softened. Perisinous abscess with copious evacuation of pus containing diplococcus intracellularis. Paresis disappeared on the third day, and the mastoid wound healed in two or three months.

The cause of the occurrence of abducens paralysis and the key to its solution will be found in the peculiar anatomic arrangement by which the sixth nerve gains its position in the outer wall of the cavernous sinus, and comes into relation with the ophthalmic division of the fifth, the fourth and the third cranial nerves, which it does immediately anterior to the first intracranial portion of the carotid artery. Anterior to this, there is no special reason why one of these nerves should be more frequently involved than the others. Posterior to this point, however, the sixth nerve is comparatively isolated and passes through a fibrous canal, called by Gradenigo "Dorello's canal," from the Italian anatomist who first described it.

There is considerable variation in different dissections of this region forms the internal boundary of Meckel's cave, cannot be considered in detail here. In all, however, the sixth nerve passes through this abducens canal, which begins where the nerve pierces the dura in the posterior fossa. In passing forward, it has the following relations: First, with the inferior petrosal sinus, which usually lies internal to it; then it passes beneath an osteofibrous bridge (to be described later), being bound to the bone in the region of the petrosphenoidal suture, and gains the posterior end of the cavernous sinus. Here it has the superior petrosal sinus above and the Gasserian ganglion externally separated only by the sinus wall, which in this region, which, although very interesting anatomically,



which contains the ganglion. It now passes through the cleft between the internal carotid artery and sinus wall, and then becomes associated with the other cranial nerves.

Arising from the posterior superior border of the petrous portion there is a spine which extends towards the posterior clinoid process. This is called the sphenoidal spine. It varies greatly in length and may be absent. Between it and the posterior clinoid process extends a thick fibrous band—the petrosphenoidal ligament. The length of these processes and this ligament mutually vary, but it is beneath the bridge, thus formed, that the inferior petrosal sinus joins the posterior end of the cavernous sinus, and the sixth nerve, lying external to it, has its most important relation to the temporal bone.

Now it is evident that narrowing of this canal may result from inflammatory thickening of its walls, or this thickening may arise from edema, caused by inflammation in the neighboring dura or bone. This narrowing, however produced, would result in pressure upon the nerve and abducens paralysis; or the inflammation may extend to the nerve itself, causing neuritis with consequent loss of function.

In the ninety-five cases collected, the cause of the abducens paralysis was ascertained with reasonable certainty in thirty-three; to be sinus thrombosis, two; meningitis, three; labyrinth disease, four; abscess in posterior fossa, nine; in middle fossa, two; osteitis, or disease of petrous tip, thirteen.

Sinus thrombosis was followed by abducens paralysis in two cases. One of these was reported by Bezold<sup>50</sup> and the other by Dr. John R. Page at the December meeting of this section, under the title "Thrombosis of the Jugular Bulb Without Apparent Involvement of the Lateral Sinus, Unusual Blood Count and Paralysis of the External Rectus Oculi." The patient, a female, age 30, had acute purulent otitis of the right ear. Myringotomy was performed on the second day. On the third day the temperature was 105°; mastoid operation, sinus exposed, seemed normal. Blood count: Leucocytes, 8,500; polynuclears, 62 per cent. Temperature varied between 99 and 105 degrees. On about the fifth day after the mastoid operation the sinus was explored, seemed normal, except that there was no return of blood from below. The jugular vein was resected. Two days later paralysis of sixth occurred and cleared up in four weeks. Dr. Page believes



that the inferior petrosal sinus was also involved, as after curetting the jugular bulb there was absolutely no return of blood, which could most easily be accounted for by assuming thrombosis of the inferior petrosal sinus. This would also account for the abducens paralysis, as we may assume the presence of inflammation or edema of the sinus wall, and hence pressure upon the sixth nerve, where it has a relation to it. It is very probable that simple lateral sinus thrombosis could not produce abducens paralysis per se, but only when the thrombosis had extended to the inferior or superior petrosal or cavernous sinuses.

Meningitis with route of infection unknown is given as a cause in three cases. This needs no special consideration, as it is easy to see how the sixth nerve could be involved, either from pressure caused by swelling of the abducens canal walls or neuritis, or involvement of the nerve as it lies on the dura in posterior fossa.

In 101 cases of otitic meningitis collected by me and analyzed with reference to symptoms, etc., paralysis of abducens was mentioned as a symptom in four cases. Extradural abscess in the posterior fossa occurred in nine cases. In some of these reports it was stated that the discharge of pus was profuse, and the abscess was known to have extended deeply along the posterior surface of the petrous portion, thus approaching the location at which the sixth nerve pierces the dura. Here edema or inflammation, slightly beyond the limits of the abscess, would result in narrowing of the abducens canal with interference with function of the nerve, or it may be stretched or compressed by the dural wall of the abscess cavity posterior to its entrance into this canal. It is certain that in some of these cases the injury to the nerve is slight and its effect evanescent, as in my case, in which recovery from the paresis was present two days after evacuation of the abscess, in Mann's<sup>54</sup> case, three days, and in Kopetsky's case, three days. When the extradural abscess is a small one it is not probable that it is a cause of the nerve trouble, but merely an incident of the inflammation of the temporal bone. Extradural abscess in middle fossa occurred in two cases. This would act in practically the same way, but in passing to the position of the sixth, the Gasserian ganglion would be encountered and produce symptoms. This occurred in one of

Wiener's cases where, in addition to an intense cephalalgia, which may reasonably be supposed to have been due to some interference with the Gasserian ganglion, there was also an eruption of herpes in the auricular region, the exact significance of which I believe is still under discussion.

We now come to that large group of cases in which the inflammatory process has extended through the bone itself to the vicinity of the nerve. That we have thirteen cases in which this is known to have taken place is a very significant fact, as I think it will readily be admitted that many other cases ending in resolution are of this type, as it is highly improbable that sinus thrombosis or epidural abscess would be overlooked. While inflammation could extend from the tympanum or mastoid through the diploe to the petrous tip, it is in bones of the cellular type that we should expect this to occur. The cells of various sizes with thin walls between form excellent paths for the passage of pus, especially if under pressure. Several different routes may be described by which the infection could reach the apex of the petrous portion:

(a) Sublabyrinthine route extending from the tympanum below the labyrinth and internal auditory meatus to the petrous tip. An interesting case in which the infection traveled this path is reported by Lombard.<sup>3</sup> Death occurred from meningitis. Autopsy showed pus in the tip cells with very pneumatic bone. On the healthy side, the cells in the petrous tip were very large, and mercury poured into them emerged in the middle ear. (b) From the mastoid antrum the infection may extend through the subarcuate fossa or petromastoid canal, which passes inward beneath the superior semicircular canal, and reach a layer of cells sometimes lying above the internal auditory meatus and thus arrive at the petrous tip, (c) or this point may be arrived at via the carotid canal, access to which is obtained either by eroding the bone on the anterior tympanic wall, or through one of the caroticotympanic foramina which give passage to the carotid branches of the tympanic plexus, or (d) finally the infection has been found in some autopsies to be through a layer of cells extending along the eustachian tube, thus passing from the tympanum to the petrous tip.

Anyone who has made many dissections of the temporal bone will readily see that this list of routes is only partial, and

that the variety and position of cells is endless. Of the thirteen cases of disease of the petrous tip, one (case of Goris') after operation, recovered, five were fatal from meningitis, autopsy proving that infection occurred from bone disease at apex, while seven were cases in which various complications in the neck occurred as a result of pus finding its way into the retro-pharyngeal space, or from swelling due to osteitis at the petrous tip.

If there was an epidural abscess in the middle fossa near the sixth nerve it would lie in immediate proximity to the foramen lacerum medium, and this passage would be its most natural way of exit. This would bring the pus into the retro-pharyngeal space. If the pus had existed in the bone and ruptured through its lower surface, it might reach the same location, provided its aperture of exit was sufficiently internal. More externally, it might follow the levator palati muscle to the lateral wall of the nasopharynx.

The remaining four cases which were known to have disease of the labyrinth are to be considered carefully, as those who advocate a reflex theory assume, I believe, that the non-acoustic labyrinth plays an important part in the causation of abducens paralysis. Two of these cases died of meningitis at the base, which was undoubtedly the cause of the paralysis. Another (case of Hastings<sup>49</sup>) had the labyrinth drained and resulted in cure in four weeks. This patient had severe facial neuralgia. The last (case of Alt<sup>57</sup>) had severe pain in the frontal region; had labyrinth opened and cure resulted, paralysis disappearing in nine days. In both of these cases the paralysis can more easily be accounted for by assuming some process in the neighborhood of the abducens canal as an osteitis of petrous apex, especially as this would also account for the severe pain in the face and forehead—symptoms which I am sure are far from common in labyrinthine disease, but, as we will soon see, are the rule in inflammatory processes at the petrous tip.

Intense headache, especially in the frontal region, severe pain in the eye or deep in the orbit, neuralgia of the fifth nerve, or paralysis of some of the muscles supplied by it, are symptoms, one or more of which have been noticed in fifty-five out of the ninety-five cases. This means that there is some interference with the Gasserian ganglion by the process going



on at the apex of the petrous portion. It was Gradenigo that first called attention to the severe frontal and parietal pains in this condition and interpreted their significance, and so this symptom, associated with otitis media purulenta and sixth nerve paralysis, is called Gradenigo's syndrome or triad. Out of fifty-one cases in which the condition of the fundus of the eyes were mentioned, changes were found in twenty-three.

Sex of patients: Male, 61; female, 24; not stated, 9.

Acute disease, 68; chronic, 17; not stated, 8. Cases have been classed as acute if under six months' duration.

The prognosis of these cases is always uncertain. Out of ninety-five cases, eleven died of meningitis, the infection occurring through the petrous tip, the labyrinth or other ways. Of the eighty-four remaining cases, recovery of abducens paralysis occurred in sixty-seven; probable recovery in five, partial in four, no improvement in one, not stated, six. We thus see that the prognosis of the paralysis itself is good.

Involvement of the sixth appeared after mastoid operation twenty-seven times; not stated, eight, and before any operative interference, sixty times. In this latter class, the operation was done in twenty-nine cases, resulting in twenty-seven cures, one death, and in one case the paralysis persisted. In the remaining thirty-one, in which the mastoid was not opened, there were four deaths, paralysis recovery partial in three, total in twenty-five. These statistics, I think, would tend to show that abducens paralysis is not, per se, an indication for operation. In some of these cases, the intense pain in the frontal region and other distributions of the fifth has been immediately relieved by opening the mastoid. This surely means that the process causing the neuralgia, viz., pressure upon the Gasserian ganglion, has been relieved by increased drainage through the mastoid and middle ear. That it takes some time for the sixth nerve paralysis to clear up does not mean that the disease process did not begin to improve at the time of and in consequence of the operation, but may be accounted for by assuming that pressure had so changed the condition of the nerve that time was necessary for it to become structurally capable of resuming its function. So, then, indication for operation would be intensity of the pain and the probability that drainage was not as complete as it should be. We should be more especially anxious about



this, as the increased pressure through insufficient drainage is acting not only upon the mastoid, which can easily be opened and relieved, but also upon the deeper parts of the petrous portion, which can only be reached with difficulty and menace to life. So the most conservative way to secure drainage would be through the mastoid in preference to performing repeated myringotomies.

The operation performed by Goris<sup>44</sup> and described at some length by Streit<sup>65</sup> shows us that the region of the petrous apex is not beyond surgical interference. In this procedure the roof of the external auditory canal and of the mastoid process are removed, and dura exposed to the superior semicircular canal. From this landmark over, the dura is separated from the bone and held away by spatulæ, and the tip curetted or the epidural abscess evacuated. Goris, in his case, found epidural abscess, and with curette removed a sequestrum from the petrous apex.

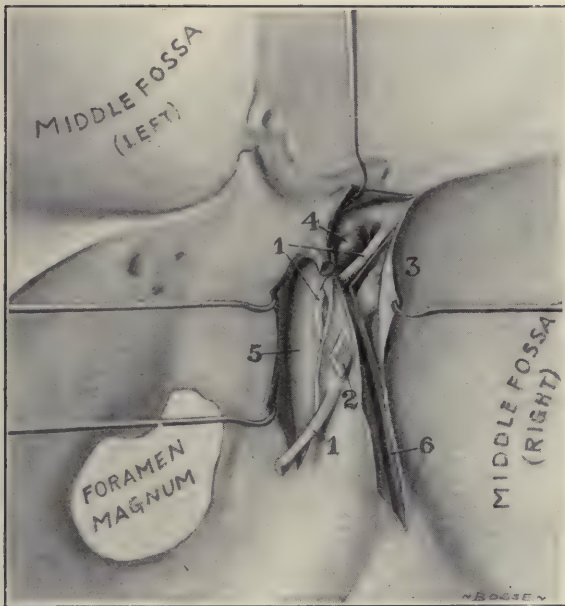
Abscesses in the pharynx, or neck, should be evacuated either by incision through the mouth or by an external route, according to their individual locations or preference of the operator. Incisions seem to be all these cases require, recovering quite promptly thereafter. In cases in which the swelling seemed to be mostly edema, multiple scarification effected a cure.

In conclusion, I would add that this article has dealt with abducens paralysis from the standpoint of the otologist and has necessarily been limited to a few of the problems of interest to him. A vast field of study has been opened up in the preparation of this paper, and it has been with difficulty that the author has kept himself within his prescribed bounds.

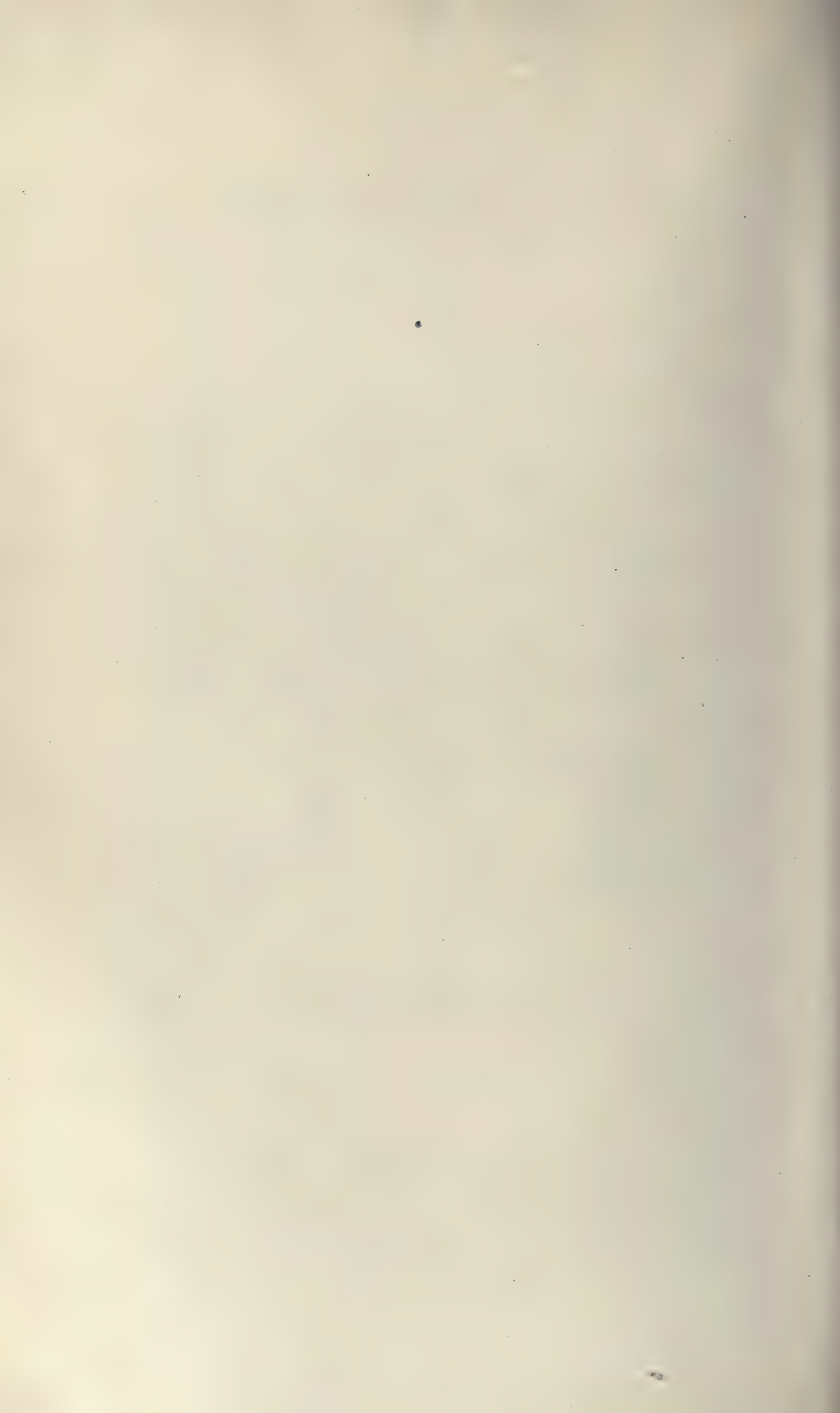
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1, Sixth nerve. 2, Fifth nerve. 3, Gasserian ganglion on fifth nerve. 4, Internal carotid artery. 5, Inferior petrosal sinus. 6, Superior petrosal sinus. The petrous sphenoidal ligament is shown cut in the figure.





### LIII.

## ABSCESS OF THE LARYNX, WITH REPORT OF A CASE.

By J. S. WATERMAN, M. D.,

BROOKLYN.

The case which I have the honor to report is that of a man, G. J., aged 42, Irish, barber, married. He came to me August 24, 1904, complaining of a slight sore throat, hoarseness and a dry, hacking cough.

*Family History.*—A brother and sister died of tuberculosis. Denies specific disease. Habits excellent. Not addicted to the use of alcohol or tobacco in excess.

*Previous History.*—One year ago he developed incipient tuberculosis at the left apex, examination of the sputum showing a few tubercle bacilli. From this condition he made a good recovery, under rational treatment, fresh air, rest and feeding.

*Physical Examination.*—Patient well nourished, somewhat anemic. Pulse 80; temperature 99.2°. Larynx slightly congested and red. Lungs normal, so far as physical examination could determine. Heart normal.

Treatment was outlined and patient told to return the next day, August 25th. Patient looked like a man who was seriously ill, and said that he felt sick. The larynx was very red and somewhat swollen. The cough was troublesome, with only slight expectoration. The following day there was some difficulty in breathing, the inspiration becoming stridulous in character. There was moderate pain on swallowing. The cough was constant, and the expectoration slightly offensive. Temperature 102°; pulse 110 to 120. Laryngeal examination showed considerable swelling of the arytenoids, aryepiglottic folds and ventricular bands. The whole larynx was intensely red.

Although a solution of adrenalin chloride was freely used,

with applications of ice over the larynx, and soothing inhalations, the swelling and edema in the larynx continued to increase with alarming rapidity, so that by ten o'clock in the evening preparations were made to do a tracheotomy. Instead of doing a tracheotomy, however, at 1 o'clock I freely scarified the swollen area, which resulted in giving the patient such pronounced relief that by half past two I was able to leave him in comparative comfort.

Immediately after the scarification the patient had a severe rigor, the temperature rising to 104, but promptly fell to 102 within the hour. The next day the larynx was much less red and less swollen. The cough was still troublesome, the expectoration very offensive and dark in color. The inspirations were stridulous in character and respirations labored.

On the fifth day the arytenoids showed as full, round masses, pale in color, and nearly filling the glottis. Dr. F. L. Tucker saw the case with me at this time. After deciding that we had to deal with a double abscess of the larynx, situated at the summit of each arytenoid, the larynx was cocaineized and the abscesses were evacuated, each discharging a foul-smelling pus, similar in odor to the expectoration. The evacuation of the pus was followed by almost immediate relief from the dyspnea.

The local condition continued to improve, and the larynx had nearly approached the normal by the seventh day following the evacuation of the pus, excepting that the color was redder than normal, and the vocal cords were intensely congested.

On the fifth day after the opening of the abscesses, there was a slight dullness found over the right lower pulmonary lobe anteriorly. Over a small area there were numerous coarse moist rales. There was no pain in the chest, and no appreciable change from the normal in voice, breathing or vocal fremitus.

This condition had existed for several days, when the patient complained that, on coughing, a mass came into his throat and nearly strangled him. A careful examination showed a larynx which was red, but not swollen; and although a view was obtained below the cords, well into the trachea, there was nothing to be seen which could account for the strangling sensations. The following morning, after a violent

fit of coughing, the patient coughed up and expectorated a fleshy mass two inches long by three-quarters of an inch in thickness. This was examined by Dr. Jonathan Wright, who reported as follows: "Microscopically the mass consists of detritus granules, a few epithelial cells and a large number of elastic fibers. Stained for bacteria, there is dimly seen a large number of bacilli, but few cocci, and these not in chains." Subsequently, Dr. Wright suggested that the bacillus noted in the sections might have been the colon bacillus.

The patient gradually sank and died on the sixteenth day of his illness. After the second day of the illness the sputum assumed a brownish color, and a very offensive odor, increasing in offensiveness and in quantity to the end. The temperature ran from 89 to 102 degrees F., with the exception of one time, when it reached 104° following the rigor.

We have here a man who had entirely recovered from an incipient tuberculosis, but was much below par, apparently dying from a septic pulmonary lesion, the nature of the offending organism being uncertain.

He was in no condition physically to resist such an infection. Without the gangrene of the lung, there is no doubt in my mind that he would have recovered from the laryngeal condition, as that was practically finished when the pulmonary complication developed.

In looking over the literature of this subject I have found the terms used to classify it as: Infectious Interstitial Inflammation of the Larynx, Submucous Laryngitis, Phlegmonous Laryngitis, Suppuration of the Larynx, and Abscess of the Larynx. The latter term seems much the simpler, as it presupposes a submucous or interstitial inflammation, and includes all of the other conditions leading up to the abscess.

Morrell McKenzie defines abscess of the larynx as "A circumscribed collection of pus, due to inflammation of the soft tissues of the larynx, interfering with the vocal functions of that organ, and sometimes with the proper action of the epiglottis."

Grunwald speaks of an "infectious interstitial inflammation." An invasion by specific microorganisms, the streptococcus pyogenes, the various forms of staphylococci, the pneumococcus, and possibly the bacterium coli. These cases do not always terminate in abscess.



McKenzie reports thirteen cases of abscess of the larynx. In six, the abscess was situated at the base of the epiglottis. In four, it was in one of the ventricular bands. In three, it was in one of the aryepiglottic folds. Of these cases, nine were opened, and four burst. All recovered.

Richards, in the *American Journal of Medical Sciences*, 1890, reports one case, and collects twenty-four. Of these, six were at the base of the epiglottis, two were in the arytenoid eminence, three were in the aryepiglottic folds, one was in a ventricular band, three were in the vocal cords, six were subglottic, two were on the internal portion of the thyroid cartilage, and two were in the pyriform sinus.

Price Brown, in the *Medical Record*, 1893, reports two cases, one of which was subglottic, and one was at the base of epiglottis. He also found one case reported by Irsay, of Budapest, in 1891. In this case the abscess was situated in the left arytenoid. He found one case reported by Milligan, of Manchester, in 1892, in which an abscess situated over the external surface of the thyroid ala, pointed internally to the laryngeal surface of the right side of the epiglottis.

LaFevre, in 1890, reported a case in which the abscess was situated at the base of the epiglottis on the right side. In this case operation was followed by recovery.

W. L. Culbert, in the transactions of the American Laryngological, Rhinological and Otological Society, reports a case of abscess, situated at the base of the epiglottis anteriorly. Operation was followed by recovery.

N. H. Pierce in the transactions of the American Laryngological Society, 1906, reports a case of "Primary Laryngeal Phlegmon" in a woman, involving first the right side of the larynx, extending from the base of the epiglottis downward. The left side became involved later. No operation was done; death occurred on the fifth day from profound sepsis.

The condition seems to be more frequent in males than in females and may occur at any age. Richards found one case at nine months and one at seventy-two years.

Grunwald says: "These cases are characterized by the sudden onset and rapid increase in symptoms. Dyspnea and suffocation in many cases set in early. In grave septic cases death sometimes occurs, from the extreme toxemia alone, before stenosis develops, as in Pierce's case. Sir Felix Semon,



in his address on "Acute Laryngitis" at the Pölhemus Clinic, mentioned a number of cases which suggested the latter class.

Richards mentions a case of Berger's, in which after two days of slight sore throat intense dyspnea suddenly developed, death occurring that same evening. He also mentions a case of Dorning's, in a soldier, who, although complaining of a slight pain in the throat, went on parade at noon, and at five o'clock was dead. Abscess of the larynx was found on autopsy.

In adults the prognosis is good in those cases operated upon, bad in those upon whom no operation is done. While the cases of McKenzie's, which were not operated upon, recovered, nature doing the surgery, Richards found ten cases, reported as not operated upon, nine of which died; while of Price Brown's cases, the one upon which he operated recovered.

In children the prognosis is bad; five out of eight reported cases died.

From four to ten days seems to be the usual time for the abscess to form, and the course to recovery from ten days to two weeks.

There is no class of cases which requires closer attention, none which causes greater anxiety, and, I imagine, none which, recovering, would give the surgeon greater satisfaction.

This case seems to be the only one on record in which there were two separate abscesses in the larynx occurring at the same time.

Cases of laryngeal abscess, due to perichondritis, are not considered in this paper.

676 St. Marks Avenue.

## SOCIETY PROCEEDINGS.

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### NEW YORK ACADEMY OF MEDICINE.

#### SECTION ON OTOTOLOGY.

*Meeting of April 8th, 1910.*

DR. JOHN B. RAE, CHAIRMAN, PRESIDING.

#### PRESENTATION OF PATIENTS.

**A Case of Abducens Paralysis Following Operation for Acute Mastoiditis Accompanied by Sinking Retropharyngeal Abscess.**

DR. J. A. KENEFICK. The patient is a necktie maker by trade, 42 years of age, who presented himself at the New York Eye and Ear Infirmary on the 1st of October last, complaining of pain in the ear. He gave a history of having had a severe cold three weeks earlier and said that the ear condition followed the cold, which he claimed was an especially severe one. It was no doubt a case of otitis following influenza. On examination there was very little discharge in the canal, but on account of the headache of which the patient complained and the ear trouble, it was decided to keep him in the hospital under observation. It was also discovered that a private doctor had done a paracentesis, which, however, proved insufficient, and a proper myringotomy was performed. The case went on to an acute mastoiditis. There was sagging of the posterior superior wall, and the severe headache was a very prominent symptom throughout the case, both before and after operation.

The usual mastoid operation was performed, nothing remarkable being found, excepting that the mastoid process presented unusual pneumatic cells throughout, some of them extending into the zygoma. There was very little pus in the cells. After the operation the principal symptoms were the headache and paralysis of the external rectus muscle of the

corresponding side. The patient was dismissed from the wards and came to the outclinic to be dressed for some time, but finally there was noticed an unusual discharge of pus from the aditus over the surface of the wound, the volume of the discharge being greater than could be accounted for. This, together with the headache and the external rectus paralysis finally determined them to place him in the hospital for further observation; but he was very discontented there and anxious to be at home. He was discharged and readmitted on several occasions, according as his condition improved or otherwise.

About January, while his wound was still discharging and there was a large granulating area, he disappeared from the clinic, and there was much curiosity on the part of the staff as to what had become of him. It seemed probable that he had become dissatisfied with the treatment he was receiving and disliked being kept in the hospital for observation and hearing his case discussed. Finally Dr. Kenefick determined to discover what had become of the man, and the official investigator of the hospital was detailed to go to his home and find out about him. She reported that his sister was dressing the case at home, that he was apparently doing very well, and refused to come to the hospital; but that he spent most of his time on his back, complaining of the headache.

After an absence of ten weeks he reappeared at the hospital, with the wound apparently healed by the home treatment, but still complaining of headache, stiff neck and the external rectus paralysis. On examination it was found that he had very good reasons for carrying his neck twisted toward one side, as he did. He said that he saw double, which disturbed him very much, and complained of a hard and tender spot over the posterior surface of the mastoid region.

The man was induced to enter the hospital again, and an attempt was made to discover where the previous flow of pus had come from, but nothing was found excepting a few cells from the previous operation, which extended down beneath the occipital bone. The tip was removed completely. After this, the patient seemed to get on very well. He developed, however, difficulty in swallowing, and on examining his throat a retropharyngeal abscess was discovered, which he said had been present just before the second operation, but that it had

not troubled him seriously. A probe was passed up to the base of the skull. Since then he has had a free discharge from the sinus in the retropharyngeal space. His mastoid wound is healing nicely, and although he still complains of headache and stiffness of the muscles of his neck, yet he is apparently making a good recovery.

It would seem that the abscess in the retropharyngeal space has been a safety valve, which has prevented the gathering of an accumulation of pus at the base of the brain.

Abducens paralysis is interesting to otologists from the fact that this nerve, perhaps more than any other, at the base of the brain, is exposed to lesions from pressure and has a long course from its emergence to its muscle insertion—the longest of any cranial nerve. The point at which it was pressed upon in this case was about where it crosses, at the junction of the petrous tip of the pyramid with the sphenoid bone.

The detailed anatomy and the explanation of the pathology of these lesions will be presented by Dr. Perkins in his paper, to follow. It is well, however, for otologists to understand the track of this nerve. It was evidently an isolated lesion, for the abducens nerve of that side not only supplies the external rectus of its own side, but has nuclear connection with the internal rectus of the opposite side. Therefore it was plain the disturbance, being confined to the external rectus on this side, that the lesion was away from the origin of the nerve, on its way to the eye.

The posterior pharyngeal abscess had evidently proved to be the safety valve in this instance. The patient evidently possesses a cancellous temporal bone throughout. Its tip is anything but petrous, and the pus by disintegration easily passed to the tip, where it joins the body of the sphenoid. How it got down to the pharynx can be surmised; it would seem that there is no other way possible than that the pus sunk through the foramen lacerum medium, finding its way to the pharyngeal surface of the sphenoid bone and down the muscles of the neck and pharynx to a point which was favorable for exit. There must have been an escape of pus between the muscles of the neck, for from time to time there were certain spots which he pointed out as being tender.

Regarding the operative procedures for the relief of such a case, there is on record one case which was operated upon



and the tip of the petrous pyramid was reached, curetted and the patient recovered. This is the first case of the kind that Dr. Kenefick has encountered in a large clinical experience. He has never before seen one so rare and interesting. Upon looking up the literature and finding that Dr. Perkins had also looked up this class of cases, he found that it was the seventh of the kind on record of acute mastoiditis, paralysis abducens and sinking abscess of the neck.

## DISCUSSION.

DR. WILSON said that if he understood correctly, some of these cases developed days after the operation, and he could not see how an abducens paralysis, due to pressure within the skull, would occur after the pressure had been removed by operation.

DR. GUTTMAN said that it was a most interesting case, so far as the abducens was concerned, but that he did not know why it should be considered a peculiar case in that the pus broke through the inner wall of the mastoid process and burrowed down into the deeper layers of the neck, forming the so-called Bezold mastoiditis. If the case was considered especially from this point of view, then it was not rare.

DR. JOHNSON said that there was a difference in this case and the cases so commonly seen extending through the posterior wall of the mastoid and opening in the neck from the inside of the mastoid tip. The interesting point in this case is the fact of its opening behind the pharyngeal muscles, probably, as suggested, through the foramen lacerum. It is not common for cases of mastoid disease with cerebral muscular involvement to open there. He would like to know whether there were ocular examinations made, further than to observe the movements, and whether there was any indication of cerebral pressure. If a sufficient amount of pus accumulated to affect the abducens nerve it would seem that there must have been pressure, and possibly that might have been indicated in the fundus. He was not inclined to believe that a diseased mastoid could open from the posterior tip and reach the pharyngeal space.

DR. KENEFICK replied that the eyes were examined from time to time, but no additional disturbance was found—no symptoms whatever of internal pressure. He himself felt com-

pletely in the dark as to just how this condition occurred, but the way he had suggested seemed to be the most likely—the foramen lacerum medium being closed with a very thin plate of cartilage, it could easily be pierced by a disintegrating stream of pus, and then the journey down to the retro-pharyngeal space would be simple. The question had been raised as to why there were not other symptoms besides the peculiarly isolated symptom of abducens paralysis, but there were none. There was no aphasia.

DR. WILSON exhibited the end of a

**Gold Wire Eustachian Bougie Measuring 2 cm. Long Which Had Broken Off in the Eustachian Tube.**

four years previously.

It was one-half centimeter from the end of the tube, and all means failed to remove it. He had devised an instrument to be pushed through the catheter and grasp the end of the wire, but it was of no avail.

It apparently did no harm, so he left it there, keeping the patient under observation. About six weeks ago he noticed the wire was approaching the pharynx, and day before yesterday the patient spat it out. When the wire became visible it was distinctly seen with the pharyngoscope, but no attempt was made to remove it, as it was working toward the pharynx. Dr. Wilson mentioned this case for two reasons: First, the danger of the wire breaking in the tube. It might have done considerable damage, but fortunately it did not, and second, it is remarkable that the wire should have remained stationary in the tube for so long a time. This patient has been catheterized regularly, and he could always feel the wire with a bougie. There was no difficulty in inflating his middle ear.

#### DISCUSSION.

DR. FOWLER said that this case showed very forcibly the ability of the eustachian tube to drain from its distal end, and how much more easy it is for matter to pass toward the pharynx than to the outer end of the tube.

DR. BERENS inquired what effect the presence of the wire had on the hearing, and also what effect was produced on the patency of the tube, to both of which questions Dr. Wilson

responded, "None whatever." Dr. Berens then remarked that the doctor was very fortunate in receiving such a kind letter from the patient. He himself, a few years ago, had received a letter from a patient asking whether he did not consider that he was guilty of a case of criminal negligence. He had lost a piece of wire in a patient's tube. He replied that he did not consider it a case of criminal negligence, because he did not wish to subject the patient to a disagreeable operation; and furthermore, that he did not consider that the wire would do any harm, but that it would later drop out of itself, as it did—and this closed the incident. In another instance, however, the wire did not come out for a year and a half, but it did no harm. In the second case, though, the hearing was very much improved—both by the patient's evidence and his own record.

DR. KENEFICK regretted that he had not heard Dr. Wilson's first remarks about the case reported, and inquired what was the position of the tip of the bougie when it broke off. Was it in the tympanic cavity, on its way in, or out?

DR. WILSON replied that it was short of the tympanic cavity and broke off on the way out.

DR. KENEFICK replied that this gave him the impression that the bougie was one of those first put on the market, made from gold-plated wire. It always had a tendency to get into a coil, and was very liable to be affected by the electric current. He has done a great deal of electrolysis of the eustachian tube, and has not had this accident, but felt uneasy about it every time he did it.

**Paper: Some Tuning Fork Tests With a Special Auscultation Tube.\***

BY LESTER MEAD HUBBY, M D.

DISCUSSION.

DR. FOWLER said that he had been much interested in Dr. Hubby's paper, as two years ago, while working out his tests for the differential diagnosis of ossicular ankyloses, he had necessarily familiarized himself with acoustic laws and phenomena, and experimented with tuning forks along lines very similar to those bearing upon Dr. Hubby's subject. In order

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\*See page 688.



to understand the tests proposed by Barany, we must constantly keep in mind several fundamental laws bearing upon the physics of sound production, transmission and perception. There are so many conflicting elements which enter into tests such as those under discussion that it is not always easy to determine which is the fundamental and deciding factor in the results obtained. Briefly, the following facts must not be lost sight of:

The intensity of sound varies inversely as the square of the distance from its source. This does not hold true if the sound is confined in tubes, for in this case diffusion is largely prevented.

Intensity depends upon the density of the air in which a sound is generated and not upon that of the air in which it is heard.

Intensity diminishes and increases with the diminution or increase in the density of the air, and is proportional to the square of the maximum velocity and to the square of the amplitude of vibration.

Velocity is directly proportional to the square root of the elasticity of the air through which sound travels, and inversely proportional to the square root of the density of the air.

Velocity, therefore, depends upon the elasticity and the density of the medium of transmission; but as density and elasticity of air vary in the same proportion and act differently, no change in velocity occurs if the temperature remains unchanged.

In closed tubes, heated air will therefore increase the velocity. In free air increased density will diminish the velocity.

Velocity is markedly affected by the loudness of a sound—in direct proportion to its intensity.

Velocity is greater in solids than in air, because the elasticities of the former are vastly greater in relation to their densities than is the elasticity of air in relation to its density.

There are many more facts which have a direct bearing on the subject, but these cannot be entered into in this discussion.

Dr. Fowler said that his experience with the tests described is not sufficient to enable him to definitely give an opinion concerning them, but he had for several hours rehearsed the tests, and found that for the lower forks the bone conduction



was greatly prolonged. This was well brought out by his own method of using twin tuning forks. The air conduction seems also to be increased for the lower forks, but this is probably not actually so, for if the nontested ear be closed while the test is being carried out, an accentuation in sounds is at once apparent. This could be so only if the sound is coming to the tested ear largely by bone conduction by way of the tubal walls and the cartilaginous and bony meatuses.

It is plain that in placing a vibrating tuning fork on the rubber tubing, we transmit the vibration of the fork to the tubing, and it is therefore by means of the oscillations of the tubal walls that the enclosed air is set into motion. This accounts for the fact which Dr. Hubby mentioned, namely, that higher forks cannot be used. The reason is that these forks are furnished with shanks so heavy that the vibrations are not transmitted to the tubing with sufficient force. This can be remedied in part by suitably constructed tuning forks and tubing.

It is apparent, then, that for the Schwabach tests we are introducing new factors, and whereas Barany's tests may prove most useful it cannot be said that we are really by them doing Schwabach or, for that matter, Rinné. Likewise Gellé by this method is changed and a new test is actually applied. Time will show if it is an improvement over the older methods.

Dr. Fowler expressed his indebtedness to Dr. Hubby for so clearly demonstrating these new tests of Barany and his own modifications thereof.

DR. HUBBY said that he had nothing to add, except that a great many theoretical conditions might be thought to influence the results, but practically this did not occur. The tests appear to work out well. According to Barany's idea, under ordinary conditions the air, tube and cartilage conduction are equal. The variations in elasticity, density and the loss by heat production in the compression tests practically balanced each other. He has taken the closed tube by itself, applied to this vibrating forks and listened with the stethoscope while the contained air was condensed or rarified and was able to detect no change in the intensity of the sound.

In regard to the old methods of obtaining the Schwabach figures, he has found them unreliable, but with this method he thinks you can get very accurate results.

**Paper: Abducens Paralysis With Otitis Media Purulenta.\***

BY CHARLES E. PERKINS, M. D.

## DISCUSSION.

DR. LOUIS FISCHER said that he had enjoyed the paper very much indeed, and that it had opened up an idea for him which he intended to follow out, but that he could not at the time discuss such a paper.

DR. KENEFICK said that he was confident all the members felt indebted to Dr. Perkins for the complete and masterly fashion in which he had dealt with this important subject. Those who have been impressed by Gradenigo's triad will not forget it and would recognize it when encountered. He had heard Dr. Perkins give his statistics in regard to osteitis at the tip of the temporal bone, and feels more than ever impressed that this was the process by which the abducens nerve was paralyzed in the case which he had reported this evening. He is also impressed with the fact that individuals who have these cellular temporal bones are especially prone to be afflicted with acute mastoiditis, and to present the Gradenigo triad so well described by Dr. Perkins.

DR. PERKINS, in closing the discussion, said that in the paper he had stated that in some of these cases there had evidently been pressure, which had been relieved by operation. He did not claim that the pressure existed in all cases; simply because the mastoid operation is done is no reason why there should not be inflammation further on. Every one who does operations on the temporal bone comes at times to some places where he does not dare curette further. The process is really outside of operative interference, i. e., through the bone itself, and in many cases of abducens paralysis the cells are inflamed at the petrous apex and produce this condition. We look for the place where the process will affect the sixth nerve and produce the intense neuralgia. That directs our attention to this spot, and there is no use hunting elsewhere. This accounts for all the symptoms, and when we get a diagnosis which accounts for all the symptoms we are on the right track. There are, however, many points about it still unsettled.

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\*See page 692.

# NEW YORK ACADEMY OF MEDICINE.

## SECTION ON OTOTOLOGY.

*Meeting of May 13th, 1910.*

DR. JOHN B. RAE, CHAIRMAN, PRESIDING.

### PRESENTATION OF PATIENTS.

#### **Cases of Chronic Middle Ear Suppuration Cured by Obliteration of the Eustachian Tube: Demonstration of Instruments.**

DR. SIDNEY YANKAUER. Some time ago I demonstrated to this section a set of eustachian sounds with a scale painted around the shank, by means of which the distance to which they are introduced can be accurately measured. I wish now to add to these instruments a set of olive-pointed bougies for diagnostic purposes, and an applicator, for making applications to the interior of the tube as far as the middle ear. The applicator consists of a wire made of a double strand of very fine wire twisted together. The end of the wire has the form of a small loop, so that it is smooth and round. The wire is contained in a handle upon which the same scale is marked as is marked on the bougies and sounds. The wire is wound with a tuft of cotton in a manner similar to a nasal applicator, but instead of leaving the end of the cotton soft and fluffy, it is bent over the end of the wire, cut off close, and rounded off between the fingers, so that the cotton protects the end of the wire, but can not double upon itself when introduced into the tube. By means of this applicator applications of cocain, adrenalin, argyrol, etc., may be made to the entire interior of the tube. Applications of cocain are used for diagnostic purposes, and applications of argyrol have been found to be of benefit in the treatment of chronic catarrhal otitis, especially when the applications are made well beyond the isthmus, in the narrow bony part of the canal, where the slightest amount of swelling causes considerable obstruction in these cases.

I have been able to demonstrate upon the cadaver that the isthmus of the tube may be reached through the external



auditory canal by means of an instrument having the proper curvature. I present here a section of a cadaver which shows the external auditory canal, the middle ear and the eustachian tube. The section is in a plane which is curved, with the concavity of the curve outward and forward. In this curved plane the auditory passage describes a curve with the concavity downwards and outwards. An instrument, such as a probe, may be passed through the external canal and into the tube as far as the isthmus. (A probe was shown lying in the auditory passage, its end lying just beyond the isthmus.)

Having ascertained this fact, a number of instruments were constructed for the treatment of the isthmus. The first of these is a knife, called the salpingotome, which has the required curvature, and which can be passed through an incision made in the anterior part of the drum membrane, into the isthmus, for the purpose of cutting a stricture of the tube at the isthmus, an operation which was performed successfully in one case.

I have also a set of curettes for the purpose of curetting the isthmus in order to produce an organic atresia of the isthmus for the cure of chronic suppurative otitis. They consist of an appropriately curved shank, surmounted by a mushroom-shaped head. They are passed into the tube through the external auditory canal, and by manipulating the instrument the mucous membrane is removed from the neighborhood of the isthmus. When there is a fairly large tube, the mucous membrane can be everted, so that its end shows in the middle ear.

Following this operation there is a reaction consisting of an edema of the inner tympanic wall accompanied by a serous transudation. This lasts two weeks, after which the mucous membrane becomes dry; it loses the moist glistening appearance of mucous membrane and becomes dry as skin, as in the ears that have been shown here to-night.

I have also observed that the perforation in the drum membrane will never close after the tube has been obliterated at the isthmus, but will become larger.

An interesting series of cases which has just been begun is the result of these observations on chronic suppuration. If the suppuration will cease after closing the tube, it must also be possible to prevent it by the same means. Hence, in a



few cases of otosclerosis in which the hearing was improved by making a preliminary perforation in the drum membrane, I have removed the entire drum and the malleus and closed the tube. The operation was followed by the same reaction as in the cases of suppuration, and after the reaction had passed off and the inner tympanic wall had become dry, it was found that the patients had not only retained the amount of improved hearing which followed the preliminary perforation, but that they had made additional gains since; in one case, after a year, the improvement seems to be still going on. These patients, of course, hear through their round window.

#### CASE HISTORIES.

*Case 1.*—Female, 42 years old, came under my care five years ago, stating that her left ear had been discharging since an attack of measles when she was three years old. For some time there had been distinct odor, and white, cheesy masses began to appear in the secretion.

Upon examination a large perforation was found, involving the upper half of the drum membrane; the ossicles had disappeared from the attic, which was filled with cholesteatomatous masses; there was a small granuloma in the anterior part. The lower half of the drum membrane was adherent to the promontory, and a small portion of the hammer handle was attached to it. Radical operation was refused. Under local treatment, including the removal of the granuloma, and of the small piece of the hammer handle, the odor disappeared, but the suppuration and the discharge of cholesteatoma continued, the quantity varying from time to time.

On August 28, 1907, the ear was operated upon. The lower part of the drum membrane was separated from the promontory with an angular knife, and the region of the eustachian tube exposed. A small quantity of pus was found in the mouth of the tube. After cleansing the ear as thoroughly as possible, the tube was curetted, the ear dusted with iodoform powder, and the canal filled with gauze. On the following day the inner tympanic wall was found swollen and slightly reddened; the discharge in the ear consisted of thin sero-purulent fluid containing small masses of cholesteatoma. The swelling of the inner tympanic wall lasted two weeks; during this time there was very little secretion, and the ear was

treated with insufflations of boric acid powder. After this the patient used instillations of alcohol, and was not seen again until October, when there was still some discharge, but it no longer contained cholesteatoma. In January, 1908, the ear had become quite dry and clean, the inner tympanic wall having the dry appearance of skin. The adhesion between the drum membrane and the promontory had not recurred; the edge of the drum had retracted so that the entire middle ear cavity was freely exposed.

No treatment of any kind has been required since then, and upon examining the ear to-night it is found to be entirely healed.

*Case 2.*—Female, 27 years old, states that her left ear had been discharging since childhood from causes unknown to her. The discharge was usually abundant, and occasionally there was an odor. The drum membrane had nearly disappeared, but the remnants of the ossicles were still present. A small polyp, as large as a pea, was attached to the malleus near the short process. The polyp was removed, but it developed again in a few days. On July 24th, 1909, under local anesthesia, the ossicles, together with the outer attic wall, were removed, the tube curetted and the ear dusted with iodoform powder. The following day the inner tympanic wall was swollen and reddened, and there was a thin mucous discharge in the ear. The swelling of the inner tympanic wall lasted about ten days, when it receded, and the ear became dry; it has remained so since, as can be seen to-night.

*Cases 3 and 4.*—Female, aged 15, states that at the age of two years double paracentesis was performed during an attack of acute illness; following this there has been a constant profuse discharge from both ears, often accompanied by odor, which was not alleviated by local treatment at various clinics.

Examination showed profuse purulent discharge in both ears; both drum membranes had disappeared, but the ossicles were present on both sides. On the right side there was a polyp of moderate size, filling about three-quarters of the lumen of the canal.

On October 8th, 1908, the polyp was removed from the right ear and the tube curetted. On the following day the

inner tympanic wall was swollen and somewhat red, and there was a thin mucous discharge, but no pus. The remains of the polyp was touched with 10 per cent. nitrate of silver twice a week.

On November 9th, 1908, the left ear was similarly operated upon.

The polyp on the right side disappeared completely after two months, but both ears continued to secrete turbid mucus until April 19, 1909, when both ears became dry. They have remained so since, and now have the dry appearance of skin.

*Case 5.*—Elsa H., 30 years old, states that her left ear has been discharging since childhood. The ear was neglected until about five years ago, when she came under the care of a competent otologist. Radical operation having been refused, she was put upon conservative treatment, which resulted in diminishing the amount of discharge, especially during the warm weather. In the winter the discharge was always profuse and purulent. The hearing was considerably diminished, whisper being heard at four inches. Examination showed that the upper half of the drum membrane had disappeared, but the remains of the ossicles were still present. The lower part of the drum membrane had become adherent to the promontory; anteriorly, this adhesion terminated in a small opening, by which the space underneath communicated with the middle ear proper, while posteriorly the adhesion extended as far as the aditus ad antrum. A bougie passed through the eustachian tube could be seen under the adherent membrane.

On November 8, 1909, the ear was operated upon. The adhesion was severed by an incision extending along its entire length. A small amount of pus escaped. This was wiped away, especially in the region of the round window, when it was found that the hearing distance had improved so that whisper could now be heard at a distance of six feet. The tube was curetted, the ear dusted with iodoform, and packed. On the following day the inner tympanic wall was swollen, there was a discharge of thin mucopurulent secretion in the middle ear. This reaction persisted for three weeks, when the swelling had completely subsided and the ear had become dry, and has remained dry since, as can be seen by inspecting her ear to-night. The adhesion in the lower half of the



drum has returned. The edges of the incision have completely retracted, so that the hypotympanum is freely exposed. The gain in the hearing which was made at the time of the operation has been maintained up to the present time. It is interesting to note that this patient has since passed through an acute inflammation of the antrum of Highmore on the same side, which healed without operation, without affecting the ear in any way.

*Case 6.*—Anna S., 21 years old, states that her left ear has been discharging since early childhood, the secretion being very profuse and often of foul odor.

Examination showed purulent secretion and complete disappearance of drum membrane and ossicles. The tube was curetted in the manner described, on January 17, 1908. The discharge became very much lessened after the operation, and on the 11th of February, 1908, had almost ceased. The patient was not seen after this date until February 5, 1910, when she stated that her ear had remained free from discharge for two months, after which it became as abundant as before the operation, and has continued so ever since.

Examination showed that a cicatricial drum membrane had formed, which nearly closed the middle ear cavity, the opening in the membrane being about as large as the head of a pin. On testing the tube by filling the ear with sterile water and inflating air through the eustachian catheter, it was found that the tube was open.

A second operation was therefore performed on the tube on February 14, 1910, but the cicatricial drum membrane was not incised, nor was the opening in it dilated. The reaction which followed was the same as had occurred in the other cases, the discharge being changed to a clear mucous discharge.

On February 21, 1910, the swelling of the inner tympanic wall had subsided, and the opening in the cicatricial drum membrane had become considerably larger. On February 28 the opening measured 5 mm. in diameter, about three times its original size. The patient has been seen since that time once a week. There is at these times only a minimum amount of discharge, although no treatment is carried out by the patient. The ear is dusted with iodoform powder weekly. By inspecting the ear to-night, it can be seen that the opening in



the cicatricial membrane has become so large that all that remains of the membrane is a narrow band around the walls of the canal.

## DISCUSSION.

DR. HARRIS said that he had been much interested in what he had known of Dr. Yankauer's work, and that he deserved the greatest amount of credit for the ingenuity shown, the time expended, and the labor put into it. The results shown speak for themselves, and if these findings are confirmed they will revolutionize our work on the middle ear. He himself has always felt that the eustachian tube has not been treated scientifically, that our bougies have been working in the dark, and that more delicate technic would effect better results. It had never, however, entered into his head to make any such treatment as Dr. Yankauer had suggested, through the tympanic cavity. It is generally held that in suppurative cases, where the radical operation is done, it is important to shut off the eustachian tube. This is undoubtedly correct, and he is justified from that in proceeding as he has done, and he should continue the work he has begun. This report to-night is only preliminary, and he will no doubt later publish in full what he has done. He has armed himself on the anatomy and physiology to prove the wisdom of what he is doing, and while the speaker is not yet fully convinced along the lines of otosclerosis, he is convinced that in these cases of suppuration there is a tremendous deal in what has been done. He concluded by congratulating Dr. Yankauer most heartily.

DR. FRIDENBERG said that the entire matter is new and opens up such a wide field that he did not feel competent to criticize, but that he would like to ask a few questions, especially in regard to nasopharyngeal conditions. Dr. Yankauer had spoken of a mucopurulent discharge, and he would like to know whether this was a condition extending from the pharynx, or a genuine tympanic infection. Many of the cases of chronic running ears are propagated otitis. There is sometimes a slim otitis without any aural discharge, and sometimes the ear begins to run and continues a long time, the secretion becomes fetid from decomposition and defective drainage, and secondary infection takes place and may simulate a pure

suppurative condition. He also wishes to know if there was any suspicion of tuberculosis in any of the cases. If one can weed out a certain percentage of cases which are limited to the attic and middle ear, and thus avoid the necessity of a radical operation, it will be a great gain. As to the technic, a very fine touch would be required, and much practical work would have to be done on the cadaver before sufficient skill and accuracy could be acquired with the instruments, especially the knife. The nasopharynx itself and the eustachian tube undoubtedly require treatment in a large proportion of cases of otitis. If we can exclude bone disease and wish to stop the infection from the eustachian tube, it is a question whether this is best accomplished by artificial obliteration. Local treatment by astringents applied to the lumen of the tube and its pharyngeal ostium and operative treatment of adenoids and postnasal anomalies undoubtedly cure many cases. It remains to be seen whether we can with impunity obliterate a canal which is of such importance for the ventilation of the middle ear and for the function of hearing.

DR. KOPETZKY said that he had had no actual experience with the method of treatment advanced by Dr. Yankauer. He had classified cases of suppurating ears into those in which the bone was diseased, and those wherein the lesion resided in the mucous membrane of the nasopharynx and eustachian tube. Some years ago it had occurred to him to attack the chronic suppurating ears in the second named group of cases, by applying treatment to the tube, and eventually stopping it up, but as his experiments progressed, he found that a similar method of treatment had already been published abroad. The tube in the book referred to is treated by inserting suppositories into the tube through a eustachian catheter. The idea underlying Dr. Yankauer's work is a distinct advance along similar lines, and he is to be congratulated upon his achievements. We should not, however, forget in those cases of middle ear disease where there is a bone lesion, necrosis, etc., that it is illogical to expect a cure of the bone lesion by any method which closes the eustachian tube and leaves the diseased bone in situ. Where the lesion is located in the mucous membrane and in the nasopharynx, and no bone lesion exists, then to expect a cure is logical and in line with the pathology, as we understand it, in these cases. We know

that it is the failure to procure closure of the tube which is the underlying factor in the failures to get dry ears, when we operate radically in this same class of cases. Furthermore, Dr. Yankauer has not shown why it is more easily possible to close the tube by his method than it is when the patient is upon the operating table and we are attempting the procedure during the technical steps of the radical mastoid operation. Dr. Kopetzky thought the same difficulties would be encountered, and in the same percentage of cases it would be found that the tube reopened.

DR. WILSON said that the method was certainly worthy of trial, and that it would require considerable skill of manipulation, but he believed that every aurist would soon be able to acquire the necessary facility. The case that had impressed him especially was the one with cholesteatoma. There the bone was diseased, and it seemed to him that the only way a cure could be accounted for was by the shutting off of the suppuration and allowing the air to attack the cavity. If such a case as that can be cured by this procedure it is a vast advance over any treatment we have yet had.

DR. KENEFICK expressed his regret that he had not arrived in time to hear all of Dr. Yankauer's presentation of this subject, but from what he had heard two conditions had suggested themselves, in which Dr. Yankauer's method would be of great benefit. The previous speakers had referred to cases of persisting suppurative otitis, but he had in mind cases where he had done an ossiculectomy in which he has been able from time to time to heal up the processes and get the ear in perfectly good condition—only to have it reinfected soon after from the nasopharynx by way of the tube. In such cases Dr. Yankauer's method of closing the tube would be an ideal procedure for establishing a permanent cure. The other condition was in certain cases where the radical operation has been performed and the fundus has apparently become dermatized, but so rapidly that there is a suspicion of space behind it, which, if it had been kept aseptic, would have granulated in, but the rule is that this skin becomes infected from the tube, and this ideal healing is destroyed by a suppurating sinus. Under these two conditions it would seem that Dr. Yankauer's method would bring about ideal results.

DR. HARRIS said that Dr. Kopetzky had given a division of



the forms of suppuration, which is more or less a classic one, but that Dr. Yankauer had shown in his suppurative cases—as had also Dr. Nagle in that remarkable series reported in Washington, 39 out of 40 cases which she cured by vaccine treatment—that there is a question whether our pathology is correct. There were forty well recognized cases, studied not merely by her but by others; while it is true that possibly an accredited aurist had not seen them, yet all these cases were cured in a remarkably short time, some after only three or four injections. It is hard to say that they were all tympanic, and not any with bone necrosis. Certainly she was not trying to deceive, but took them as they came. As Dr. Wilson pointed out, cholesteatoma is a bone disease, so it is a question of whether our pathology is correct. Dr. Kopetzky's conclusions that Dr. Yankauer's work appears to be indicated only in cases of tympanotubal disease is hardly warranted; there is more in it than that; there is encouragement for cases where there is distinct involvement of the bone itself.

DR. KOPETZKY said that he had no desire to detract an iota from Dr. Yankauer's achievements, but that he had merely tried to call attention to what appeared to him to be limitations for the employment of the procedure, for it was a fact that many good procedures eventually fell into disuse because they were not applied logically. Regarding the paper of Dr. Nagle to which Dr. Harris had referred and upon which he based his opinion that a revision of our knowledge of ear pathology was impending—he informed the section that the paper in question was open to serious question, because no exact otologic diagnosis has been made in the cases Dr. Nagle reported, and therefore the keystone of the arch was missing, and our pathology can stand in the face of this report.

Regarding the case of cholesteatoma which Dr. Yankauer reported as among the cases which he cured, he wished to impress the fact that cholesteatoma was not a bone lesion. It is a new ingrowth of epithelium; the destructive process that we see in the bone is the result of the growth of this epithelial mass—the result of pressure and bone absorption—an osteitis rarificans. When you remove from a small cholesteatomatous mass its supply of moisture and permit the air to have access to it, it will be found to disintegrate into dry epithelium and can be shaken out. In the case to which Dr. Wilson called



attention this is what was done, and hence the good result. In such a case the procedure seems to be logically applied also. Finally he thought that in selected cases, applying the procedure where it seemed logically indicated, we might expect uniformly good results. Neither the advocated procedure nor the reports on vaccine therapy at hand have up to now given anything upon which we may justify a statement that our pathology is wrong. Dr. Kopetzky has started investigations as to the action of vaccine therapy in cases of clearly diagnosed bone lesions in the middle ear and adnexa, and said that as yet he has seen no good result from their use in such cases.

DR. YANKAUER, replying to the question as to the manner in which this form of treatment works, said it is his belief that a large percentage of the cases of chronic suppuration have a profuse discharge, not because the secretion has formed in the middle ear, but because the patients are blowing their noses through their ears—they are ejecting nasopharyngeal mucus through the tube into the ear, and thus maintain a constant infection and keep up any disease process that may exist in the ear. In the cases he had operated on, quite a number had polypi, and there were a number in which distinct areas of necrosis could be felt with the probe, and several cholesteatoma cases. Polypi cases were treated with nitrate of silver—for an aural polyp is merely an exuberant granulation. A few of the cases had no evidence of bone involvement, and they healed rapidly; the discharge never returned after the tube was closed; the ears became dry and have not discharged since. Where polypi were present it took a longer time—weeks, or months, perhaps. The history of one case which had not been present to-night illustrates better than the others the course of such a case. The patient was a young woman of twenty, with a chronic suppuration in her left ear. On examination a large polyp was found in the bottom of the canal, which obscured the view of the middle ear. It was attached to the posterior part of the promontory; the eustachian tube was closed by an adhesion of the drum membrane to the promontory. The adhesion was incised, the probe passed into the tube, and the floor was found to be necrotic, the necrosis extending along the floor of the middle ear almost to the posterior wall. This necrotic bone was curetted carefully and the

tube was closed. The polyp was treated with applications of nitrate of silver. In four to six weeks the polyp had shrunk to a little nodule on the promontory, but the suppuration had not ceased. Examination showed a black mass in the attic, which was tender to the probe, and which was thought to be a necrotic or gangrenous incus. The patient refused operative interference, and accordingly it was left alone. One day, several months later, the patient had a blood-tinged discharge which lasted for a day, and the next day this mass had disappeared, and the probe could be moved about freely. After this, which seems to have been a spontaneous discharge of the incus, the suppuration diminished rapidly and only a small crust was left on the outer attic wall. The crust reappeared in a few days and was again removed. The last crust was removed in January of this year. She has been seen since, and it has not recurred. She is apparently completely cured. It is interesting to note that the point on the promontory from which the polyp grew has been converted into a depression. The vertigo from which she suffered has disappeared, the hearing has been good and has remained so.

In regard to the question of ossiculectomy: A few years ago a symposium was held on this subject in the Otologic Section of the American Medical Association, and the consensus of opinion was that ossiculectomy does not cure the suppuration. Dr. Yankauer said that he has seen several cases where it was apparently cured, but that he had never seen the inner tympanic wall dry up, as it does after closing the tube. He had purposely omitted ossiculectomy, and the inner tympanic wall had dried up in spite of the fact that the ossicles remained; in the cases in which they were removed, there was evidence of distinct necrosis, so that in these cases the ossiculectomy unquestionably expedited the healing.

As to the technic, this will be fully described in an article which will appear later. At present he would only say that the auricle must not be drawn up and back, as is done in examining the ear, until the end of the instrument is in the middle ear. The instrument is then guided into the orifice, and it will find its way into the tube. He first practiced this introduction by means of a probe, and advised that it be practiced in this way until the feel is acquired; curettement is done by the sense of touch. The manipulation of the instrument is performed

as follows: After the curette is introduced the handle is depressed or raised in various directions, and by a sort of circular motion the mucous membrane of the tube is incised all around the tube; then by an in-and-out movement the mucous membrane is separated, and the instrument is withdrawn; in some cases the mucous membrane can be everted, but not always; the isthmus is not always smooth and round, but it is often angular, in which case the mucous membrane will tear, so that only shreds will be brought out. The shape of the isthmus can be ascertained before operation by the use of the eustachian applicator, allowing it to remain for a few moments in the isthmus; when the applicator is withdrawn the cotton tuft will assume the shape of the isthmus. In curetting the tube at the radical operation the mucous membrane is curetted only on the floor; the instrument does not curette all around, and on the floor of the tube, especially toward the tympanum, there are a number of irregularities, often quite deep. All of this has to be curetted away in order to insure closure of the tube; the curetting at that point is rather dangerous on account of the carotid artery; but it would seem impossible to injure the carotid artery with these instruments, for if the largest one is used the instrument is held in position by the walls of the tube and cannot plunge through; the shape of the head is also so formed that it would be difficult to go through except in case of a very large dehiscence; the projection of the head from the shank is not more than a quarter of a millimeter, and that is not greater than the thickness of the mucous membrane.

**A Case of Mastoiditis With Atresia of the External Auditory Canal and Persistent Middle Ear Discharge. Unusual Operation and Recovery of Hearing.**

DR. JOHN R. PAGE. Eight months ago this patient suffered from a severe streptococcus cellulitis, which began in her external auditory canal, and later involved the whole side of her face and neck to such an extent that her life was endangered. After the cellulitis had subsided the walls of the canal still lay in apposition, and the drum membrane could only with difficulty be seen through a very narrow speculum. In spite of her having no recollection of any previous ear trouble, a perforation was discovered in the drum membrane, through which a very foul discharge continued for two months or



more. A piece of gauze had to be kept in the canal to afford an escape for it, as ordinarily the swollen walls completely occluded the canal. Mastoidectomy was performed, with the radical operation in view, but as the middle ear, ossicles, and attic were not extensively involved, the effort was made to save them. The tip and bone throughout the mastoid were removed to the inner plate, and the posterior wall of the canal was cut down almost to the annulus. Because of the marked atresia of the canal, its walls had to be split and folded back and a new meatus cut. This afforded room for drainage of the cavity, so the posterior incision was closed.

Dr. Hopkins has followed a similar procedure in cases where no atresia existed, and there has been some discussion as to whether his operation is entirely justified in such cases. It is satisfactory to note in this case that there is no deformity and that the hearing is excellent, the canal being no longer occluded. The middle ear is dry, and the drum membrane is intact.

CASE 2.—The next case is of interest only to show a satisfactory result where there was a total atresia of the external auditory meatus for over a year, resulting from a stab wound. Bone conduction was very good, but there was practically no air conduction except for very loud sounds. After the auricle had been brought forward from a posterior incision and the cartilaginous canal had been cut through transversely, a wide canal and a good membrane were discovered. The atresia extended inward from the meatus for a short distance only. This part of the canal was excised, a new meatus was cut in the concha, and the posterior incision was closed. Air conduction is now better than bone conduction, and his hearing for watch is 30/40; for whisper, 25 feet plus. Both of these cases were taken from Dr. Duel's clinic at the Manhattan Eye, Ear and Throat Hospital.

**Brain Abscess Simulated by Acute Suppurative Otitis Media Complicated With Acute Polioencephalitis and Myelitis.**

**Acute Labyrinthitis Simulated by Inflammation of Geniculate Ganglion and Herpes Auris.**

DR. JOHN MCCOY. These two cases are presented because of the interesting association of diseases. The first patient is a little girl five years of age. She applied for treat-



ment on the 8th of February with a history that two weeks before she had developed a severe pain the right ear, followed by discharge the next day. The ear was irrigated and discharged for a week, when it ceased, then the child became increasingly drowsy; by the end of the second week she was quite lethargic and noticed nothing about her. She was also noticed to walk with a limp and finally refused to walk at all. She then developed a paralysis in the left arm and leg. When first seen she was in this condition, and the ear discharge had reasserted itself the previous day. On examination, the drum was found to be edematous and swollen, with a drop of pus in the bottom of the canal; temperature  $102^{\circ}$ , pulse 68. The child had been vomiting, apparently of the projectile type, for past 48 hours. She was in a condition of profound lethargy. When roused, she would notice things, and even talk, but wanted to sleep all the time. She was brought to the doctor, with the diagnosis of possible cerebral infection, following acute infection of the right ear. She was sent to the hospital for observation and the drum was incised that afternoon. She remained in a drowsy, stuporous condition all that night, but was seen to move the left foot and also the fingers and lower part of the hand spontaneously the next morning.

The possibility of a combination of anterior poliomyelitis associated with ear disease then suggested itself. That night she was brighter, and the next day she was seen in consultation with Dr. Hunt, who said that the condition was not only anterior poliomyelitis, but polioencephalitis also. He gave a hopeful prognosis, which was borne out, and the condition cleared up, the child leaving the hospital five days later, bright and active, with the paralysis in a clearing condition.

The other case occurred in a child five and one-half years old, who was brought to the office with the history that one month earlier he had for two weeks complained of earache. He had been taken to a local doctor, who prescribed some drops, but no discharge was seen for two weeks. The earache was not continuous; he would go to sleep and wake up with it, and then would sleep and not complain of pain until the next day. At the end of two weeks there was a slight discharge; some matter which they did not call pus, but described as a discharge of thin material, which lasted for three days and then ceased. Four days later the youngster in trying to get

up was noticed to fall over, and on trying to walk he fell over to the right side. He was then taken to the family doctor, who referred him to a neurologist. The neurologist decided that there was no symptom of cerebral lesion, and referred the case to Dr. McCoy with the idea that there had been a suppuration in the middle ear that had extended to the internal ear and set up a labyrinthitis.

When Dr. McCoy examined him he walked to the right side, his temperature was normal; the drum was slightly congested, the hearing was nearly normal, there was no spontaneous nystagmus, and on testing his vestibular apparatus by the caloric turning tests, it was found to be normal. There was an apparent labyrinthine irritation without labyrinthine involvement. There were a number of vesicles in the ear, and this, with the fact that the internal ear was acting normally, suggested an inflammation of the geniculate ganglion, producing reflex irritation of labyrinth, also producing herpes.

The child was put to bed and kept quiet, and at the end of three weeks, without other treatment, he was normal and able to walk perfectly, and showed no further disturbance.

#### Case of Objective Tinnitus Aurium.

DR. DAVID G. YATES. The patient is a married woman, thirty years of age, of a nervous temperament. Three months ago she was suddenly attacked with a loud roaring tinnitus, one-sided, which has never left her since. During the past three weeks it has been rather worse. The sound can be plainly heard by others. It can be stopped by light pressure upon the soft tissues behind the angle of the jaw and by turning or bending the patient's head toward the affected side. This is the only way in which she can obtain relief. The sound is described as similar to the preliminary scraping of a phonograph. The eustachian tubes are open.

The patient had an acute suppuration in both ears eleven years ago, but the hearing is normal, or nearly so, when the tinnitus is suspended by pressure. There is no other history bearing upon the present condition. The patient is exceedingly nervous and easily excited; the pulse is 120, and the eyes slightly prominent, almost suggesting exophthalmic goitre. The case is presented in the hope that some suggestions for treatment may be offered.

## DISCUSSION.

DR. HARRIS said that the case was an exceedingly interesting one and that he had never before heard anything like it. It was quite different from the usual cases of objective tinnitus, and he had no explanation to offer. A very interesting case had been shown by Dr. Alderton at the New York Otological Society a year ago, in which there was a clicking sound that was more or less under the control of the will, and was apparently associated with the tensor tympani muscle. The girl could apparently interrupt it at her pleasure. In the earlier part of the day he had listened to one of the worst cases he had ever heard, a case of which some of the Mount Sinai men might know—a woman with a very pronounced aneurysmal bruit directly behind the ear. Dr. Elsberg had operated upon it, using the usual mastoid incision, but signally failed in securing relief. Deep pressure in that case would stop the sound; deep pressure in the place where in Dr. Yates' patient light pressure will stop the noise. A fourth case which he recalled was one that Dr. Kenefick saw, where the occipital artery was the cause, and where the man who had charge of the case was contemplating operation.

DR. FRIDENBERG said that it was his impression that this condition was of vascular origin; the tinnitus has a peculiar rattling character, and pressure on the carotid stopped it instantly; it is not subject to the patient's will at all, so any action of the muscles can be excluded. There are some interesting points about the patient's condition, especially the prominent eyes, and he would like to know if the heart has been examined. She has a rather bounding, rapid pulse.

DR. YATES stated that the heart had been examined, and the patient's pulse was 120.

DR. FRIDENBERG said that if the sound annoyed her very much he would suggest that a mild compression, if kept up, might relieve her. This pressure it was evident could be so slight as to cause no marked congestion or other embarrassment. The peculiar character of the tinnitus, which closely resembles a coarse, moist bronchial rale, and the fact that it disappears for a time after Valsalva, suggest a rather curious etiology, viz., that this rattle takes place inside the eustachian tube, and is caused by mucus in the lumen and by alternate contact and separation of the walls of the tube, or perhaps, mere displace-



ment of the mucus by the transmitted pulse wave from the carotid. A dehiscence in the roof of the carotid canal would explain the transmission of the mechanical pulse wave.

DR. KENEFICK said that an interesting point was the fact that it began only three months ago. He agreed with Dr. Fridenberg that an inquiry into the patient's general condition would be very valuable. She certainly has an exophthalmia, and it should be determined whether these are related conditions. There was no doubt of its vascular origin.

DR. YATES said that he had examined the patient very carefully, and beyond what he had already stated he had found that the noise is stopped momentarily by autoinflation of the middle ear by the method of Valsalva. She has been helped by bromide, which seems to have greatly decreased the noise, and altogether she is much more comfortable than she has been.

**A Case of Erysipelas Following Mastoidectomy, Treated With Hiss' Leucocyte Extract.**

DR. RAE submitted a chart for the purpose of placing on record the treatment of a case of erysipelas, following the mastoid operation, by the leucocyte extract of Hiss.

The patient, Miss S., underwent a simple mastoid operation at 8:30 p. m. on Saturday, April 2nd. The following day the temperature rose to 103.4°. The outer dressings were removed and a small amount of white edema around the wound was observed. Next morning the temperature had reached 105°, and distinct evidence of erysipelas was present. A complete dressing was done, the iodoform packing being replaced by plain gauze. The erysipelatous area was dressed with ichthyol-vaseline, and large doses of tinct. ferri perchlor. were given internally.

The same afternoon treatment with the Hiss extract was started. Each dose consisted of 10 cc. of the serum. Two injections were made the first day, and three on each of the succeeding days, at the hours noted in detail on the chart. The temperature during these days ranged between 104.8° and 105.8°. The erysipelas extended over the whole scalp, as low as the clavicles in front, and gradually faded out about the level of the low edge of the scapulæ behind.

It would be absurd to attempt to draw any conclusions from



this one case. It does not appear that the extract exerted any influence on the temperature, but it is worthy of note that throughout the entire duration of this intense cellular inflammation the sutures held, the wound remained clean, and has since pursued a normal course toward recovery. Although most cases of erysipelas complicating the mastoid operation recover, still its occurrence in a patient of fifty-five years, with a temperature for four days in the neighborhood of  $105^{\circ}$ , must, of necessity, be a source of grave anxiety. This patient withstood the disease excellently. She was not aware that she was critically ill, was mentally clear throughout, and needed no stimulation. It therefore seems but fair to attribute to the Hiss extract the credit of enabling the patient to combat the disease, even if no specific effect can be claimed for it.

#### DISCUSSION.

DR. McCULLAGH said that within the last week he had a case of erysipelas, developing a week or two after a frontal sinus and ethmoid operation. The patient, a woman, was older than Dr. Rae's patient, and the Hiss extract seemed to have a very good effect on the erysipelas; the patient is still under observation. As he understands, this is a routine treatment in Dr. Lambert's service, in Bellevue Hospital, for erysipelas. Dr. Hiss had stated to him that the results he had obtained with the serum treatment in erysipelas, when taken early, were certain and rapid, the cases clearing up in twenty-four to forty-eight hours.

DR. KOPETZKY said that he had nothing to add to the history presented; but, in regard to the effect of the Hiss treatment on the temperature, cited a case which is just clearing up after a postoperative sinus thrombosis. The patient had a very high temperature and nothing seemed effective in reducing it, until the Hiss serum was tried, and with every injection there was a distinct drop in the temperature. In another case, the pulse rate came down, and the child seemed to be rested for the time being, as though it had had a good meal. The treatment seemed to be of assistance in the course of the septic diseases.

In reply to an inquiry from Dr. Harris as to what his opinion on this subject was, Dr. Rae said that he thought it helped the patient to fight the disease. The extract having been

administered early, it is impossible to say what would have been the course of the disease had it been withheld. For this reason only can no opinion be offered, as far as this case is concerned, as to the effect of the extract on the temperature, but the reported experiences of others seem to indicate that the higher temperatures are reduced by its administration.

DR. PAGE said that he recently had a case of sinus thrombosis and perisinus abscess in which the jugular vein above the entrance of the facial was entirely collapsed, the sinus itself containing fluid pus. After the excision of the vein and the usual operation on the sinus, the patient was put on Hiss' extract and did unusually well, there being no reaction from the operation in spite of the temperature of 104 that preceded it. Dr. Dwyer administered Hiss' extract for a week, during which the temperature was not higher than 101. It was then discontinued for a day, and the temperature immediately went up to 103.5. This was probably a coincidence, but it was nevertheless a fact, so Hiss' extract was again administered for a few days and the temperature remained down.

DR. KENEFICK said that apparently we have in this extract an agent which will be of great use in cases of mastoiditis developing erysipelas. It is very hard for such patients to be sent away; if we can provide for them in our own hospitals and put them on the Hiss extract it will be a distinct advantage.

## NEW YORK OTOLOGICAL SOCIETY.

*Stated Meeting, March 22, 1910.*

JAMES F. MCKERNON, M. D., PRESIDENT, IN THE CHAIR.

### **Mastoiditis.**

DR. F. T. HOPKINS presented three patients upon whom he had operated for mastoiditis, closing the posterior wound absolutely at the time of operation, thus materially shortening the period of healing. The wound is drained through the external auditory meatus, and healing takes place in the canal itself. The hearing is practically the same as in the other ear. The only objection to the operation is that of deformity, the external meatus being somewhat larger than normal. Healing takes place in from four to six weeks, which is a distinct advantage in many cases.

### **DISCUSSION.**

DR. DENCH, referring to the question of disfigurement, said that while the meatus is larger in cases operated upon by the method under discussion, unless one looked for it, the deformity would not be noticed. The length of time it is necessary to wear a bandage, or even a pad, is important. The earlier the bandage can be removed the earlier will the patient, in many instances, be able to return to work. He had been very favorably impressed by the method.

DR. GRUENING did not consider the retention of hearing a point in favor of the operation under discussion. With the old mastoid operation the hearing is not ordinarily affected, nor is it expected to be affected. He believes in a large wound and thorough drainage. The disfigurement caused for three or four weeks by the bandage in the old operation is inconsequent, compared with the permanent disfigurement produced by this new method. The advantages of the shorter healing do not counterbalance this permanent disfigurement. Should there be additional areas of necrosis they cannot be reached so readily as by the open wound. While the cases

presented were shown as good results, he would rather consider them failures because of the unnecessary disfigurement. A scar behind the ear is not objectionable, but a large canal, particularly in a young girl, is certainly to be so considered.

DR. DENCH said he was skeptical concerning this operation when he read Oscar Wolf's description of it long ago, but since seeing it, as performed by Dr. Hopkins, he had changed his opinion. The time of healing is undoubtedly greatly diminished, which is a distinct advantage, especially in those who have to return to work early, as it obviates the necessity of wearing the bandage and the consequent disfigurement.

DR. PHILLIPS believed the only possible advantage of the method under discussion to be the shortening of the time of healing the external wound. Over against this is the deformity, which is a very material disadvantage.

DR. DENCH said that it had been his practice to remove the entire tip in all cases of acute mastoiditis. Sometimes a pretty deep scar resulted. The lack of scarring in Dr. Hopkins' method depends upon placing the depression on the inside rather than on the outside.

DR. H. A. ALDERTON called attention to the fact that the amount of deformity in the ordinary mastoid operation is lessened if the entire tip is removed. The tendency to sink in is not so great when this is done.

DR. GRUENING, referring again to the disfigurement, said the scar behind the ear depends upon the nature of the mastoiditis. If it is necessary to remove much bone the scar will be just as deep as in other cases.

DR. HOPKINS, replying to a question by Dr. Gruening, said he had performed the operation in fifteen cases. All did well except two. One of these did not do so well, because the posterior wound was injected with adrenalin solution for the purpose of controlling the bleeding, and as a consequence the wound broke down, so that healing did not take place in the usual satisfactory manner. In the other case the dressing was done by the house surgeon. The posterior wound broke down, the healing was very unsatisfactory in its progress, but the result was good. The hearing was exceedingly good in each case.

DR. MCKERNON asked how much, proportionately, of the posterior wall is taken away; also whether, in making the flap,



it is split, one part being carried above and the other below.

DR. GRUENING thought better drainage could be obtained by splitting the canal, just as is done in the radical operation.

DR. HOPKINS said that middle ear drainage is better in these cases than where the ordinary mastoid operation is performed. Drainage through the aditus is perfect and can be observed. The canal being large, better drainage can be secured than in most cases in which the canal wall sags, shutting off the membrana tympani from view, so that it cannot be examined carefully, and preventing perfect drainage through the canal. In the first week or two following the ordinary mastoid operation there is a large amount of pus in the middle ear, which it is hard to drain.

#### Modified Noise Producer.

DR. PHILLIPS exhibited a modified noise producer consisting of an ordinary telephone receiver attached to a faradic coil. The sound is conducted through rubber tubing to glass ear tips. The current supplied may be obtained either from dry battery cells or the street current, controlled by a suitable rheostat.

#### Tinnitus.

DR. MAX TOEPLITZ reported two cases of peculiar tinnitus. The first, a man, thirty-five years of age, was sent to him as an ear case. When he examined the left ear, in which the patient complained of the trouble, he found it perfectly normal. The man described the trouble as "hammering in the ear." His heart was examined and found to have a mitral lesion, which was probably the cause of the "hammering" in the ear, the only symptom of which he complained. The second case was a woman, fifty-one years of age, who complained of noise in the left ear, which was like a constant roaring day and night. The ear in this case was found to be almost normal. All the tests with tuning forks gave normal results, also Galton's whistle. Hearing for the whisper was somewhat lowered. When asked about the noise the patient said, "You can hear it if you will place your ear to mine." This was true, the roaring noise could be heard. By pressing the finger upon the tip of the mastoid, on the anterior surface, the noise disappeared. Behind and below the mastoid a distinct pulsation could be felt. The patient had been examined by a neurolo-

gist and had been admitted to Mount Sinai Hospital for operation for aneurism of the occipital artery. The operation was performed the day before (March 21) by Dr. Elsberg. The occipital artery was found very much enlarged and was removed.

It was first suggested to the patient that she have made an instrument similar to that employed for the retention of a hernia, to be pressed upon the place where the pulsation was felt. It was afterwards decided that it would be wiser to operate. The speaker knew of no case reported in the literature in which the artery produced a noise which could be heard outside the ear, and where it could be heard by the examiner.

#### DISCUSSION.

DR. GRUENING asked whether compression upon the carotid would stop the noise. The question was answered in the negative. Dr. Gruening then continued the discussion. Arterio-venous aneurism occurs in the head more frequently than might be imagined. It is a symptom known to ophthalmologists. The internal carotid as it passes through the cavernous sinus communicates with the sinus, giving rise to these noises. Compression of the common carotid generally stops the noise.

DR. DENCH called attention to the fact that a sudden twist of the head may cause compression upon arteries, which will give rise to tinnitus, which is synchronous with the heart beat.

DR. ALDERTON called attention to a similar case, which he reported some time ago, and which is still under observation. The noise will disappear and then return, and can be heard in either ear. It is not due to aneurism. He cited another case, a young woman, referred to him by Dr. Butler, of Brooklyn. The girl had been under considerable strain, and Dr. Butler thought the condition due to vasomotor disturbances. If the first patient's head is turned so that she cannot contract the muscles of the neck and throat the noise will disappear. When she gets the muscles under control again the noise is again heard.

DR. DENCH referred to two cases reported by Professor Halsted, of Baltimore, in which tinnitus was caused by dilatation in the carotid ventricle. Cases due to dilatation or aneurism of the vertebral artery are common.

DR. HARRIS said that while the case presented by Dr. Toepnitz is unique and the only one on record where the noise was audible to the examiner, with involvement of the occipital artery, he recalled a case where the noise could be controlled by pressure upon the artery. No operation was undertaken in this case.

DR. TOEPLITZ, closing the discussion, said he had thought of jugular aneurism, as suggested by Dr. Gruening, and had thought of ligating it. Six years ago the woman had had a distinct attack of vertigo, which occurred suddenly, at night, and which lasted for six weeks, during which time she was in bed. She was unable to raise her head. She had had no further trouble until five weeks ago. The test was made for nystagmus. He could not say whether there was a lesion in the labyrinth.

DR. DENCH reported a case of

**Destructive Process in the Mastoid, Giving Rise to a Very Few Symptoms.**

The patient, a boy, was brought into the New York Eye and Ear Infirmary with a history of earache eight days before. There was slight tenderness, with a suspicion of fullness behind the ear. Contrary to the usual practice, he opened the mastoid at once. The sinus was found to be rather superficial, and behind and over it was an epidural abscess of considerable size. The patient was doing well. Dr. Dench emphasized the importance of making a distinction between cases in which there has been spontaneous perforation or those where drainage has been effected by myringotomy and such cases as the one reported, in which there had been no middle ear drainage. Where an acute middle ear infection has existed for eight days any damage in the mastoid has already been done, and any operation upon the middle ear will simply mask the symptoms. In such cases, with the slightest indication of mastoid involvement, he would open the mastoid. If drainage has resulted from spontaneous opening or from myringotomy he would wait a little longer.

DISCUSSION.

DR. GRUENING suggested that the symptoms might subside and the mastoid involvement continue.



DR. HARRIS considered the question of the most advantageous time to operate in acute mastoiditis a very difficult one to decide in many instances. In the presence of typical symptoms one may safely proceed, but in difficult cases, such as those reported by Dr. Dench and Dr. Lewis, it is not so easy to determine the wise course to pursue. Where the perforation, if there has been one, has healed, with possibly a little redness of Schrapnell's membrane, perhaps marked mastoid tenderness, when the case is first seen, and perhaps a history of a discharge from the ear lasting a few hours, there is doubt as to what is best to be done. He cited a case in a young girl, who reported very severe pain in the ear, lasting twenty-four or forty-eight hours, then disappearing. In this case the drum membrane looked normal when he first examined her. There was slight injection along the manubrium, and there was distinct pain upon pressure upon the antrum. There was a difference of opinion among those who examined her. Operation was delayed. The tenderness over the mastoid very rapidly disappeared, and in three days, without any treatment whatever, entirely ceased. There was no sagging of the canal and nothing to point to middle ear trouble.

DR. DENCH had previously reported three cases similar to the one mentioned by Dr. Harris. In all of these cases there was haziness of the drum membrane, which was not true in Dr. Harris' case. The speaker had seen mastoiditis develop six weeks after first examining the case, and when it was under observation, once or twice a week in the interim, the only evidence of mastoiditis being the posterior swelling. One cannot be too careful in these cases. A certain number of cases of meningitis of unexplained origin will later be found to be due to mastoid involvement traveling inward toward the meninges instead of outward. He had reported a case in which infection had laid dormant in the mastoid for three months. The man in this instance had been in perfect health for three months after an acute attack, and had sought advice on account of his hearing. Cases of this kind form a distinct class.

DR. LUTZ mentioned in this connection a case of acute mastoiditis which had apparently cleared up. The patient disappeared for some time, and when he returned for treatment the only symptom of which he complained was pain, which



began the night before. There was no swelling and no discharge. The mastoid was opened and found to be extensively involved.

#### **Temporosphenoïdal Abscess.**

DR. SEYMOUR OPPENHEIMER reported an unfortunate case accompanied by many peculiar features. The patient, a young girl, twenty-two years old, was first seen by him the middle of last December. She was then suffering from acute mastoiditis of the right side. The preceding history was not particularly interesting, and the operation presented nothing unusual. A large pneumatic mastoid was found, with extensive destruction in the interior. A small area of bone over the roof of the tympanum was destroyed. A very small area of dura was exposed. It was necessary during the ten days the patient was in the hospital to give her something to quiet her. The mastoid wound healed promptly, being entirely healed at the end of six weeks. During this entire time the patient complained of very severe headache, particularly on the right side, but sometimes on the other side. The temperature was taken regularly, the highest being 99.4°. The girl was unable, on account of the headaches, to go to the office for dressings during the six weeks. The family physician gave all sorts of medicine for these headaches, sometimes giving as much as six grains of codein in one day. A series of blood examinations revealed no excessive leucocytes. The polymorphonuclear count was normal. Ocular tests were made at intervals, all of which proved negative. Three neurologists saw the patient, and the opinion expressed by them was that the girl was suffering from inflammation of the geniculate ganglion. She was also said to be suffering from hysteria. The mastoid wound having healed, it was the opinion of all that there was no intracranial involvement. Negative examinations of the fundus of the eye, normal blood counts, etc., led to the belief that the neurologists were correct in their diagnosis. Two neurologists decided that she must be removed from her home surroundings and away from her family, and arrangements were accordingly made to send her to the country. The day before she was to leave she showed the first evidence of slight facial paralysis on the opposite, left, side of the face. There was also distinct weakness of the extremities on the right side. Ocular examination revealed double

choked disk. Four days before this report was received another ocular examination was reported negative. It was inferred from the finding of the choked disk that we were dealing with brain abscess. The patient was taken to the hospital and an operation performed. In going through the old wound and uncovering the tympanum it was found that the small area of dura exposed at the previous operation was now about three times as large as at the time of the first operation. A bony absorption had taken place about the dural exposure. An incision was made in the dura, and more than an ounce of pus evacuated from the temporosphenoidal lobe at a depth of about an inch and a quarter. At the time of the operation the girl was in a state of coma, with a pulse rate of not over forty. No anesthetic was given. Two hours after the operation the sensorium was perfectly clear, and the pulse rate increased to eighty or ninety. Following the operation the highest temperature recorded was  $100^{\circ}$ . On the eighth day the girl became drowsy, the temperature rose to  $100\frac{1}{2}^{\circ}$ , and the headache, which had disappeared, returned. The wound was promptly dressed, and in withdrawing the gauze drain a small quantity of pus was removed. An encephaloscope was introduced, thinking there was another abscess cavity, but none was found. The patient became more comatose. Lumbar puncture was made and cerebrospinal fluid withdrawn. Bacterial examination of this fluid was negative. The girl died the following day.

The speaker cited another case, which was operated upon sixteen years ago by Schwartze, and which had been under his own observation for four or five years. The exposed sinus in this case is more and more visible, the surrounding bone seeming to undergo absorption all the time. When he first saw the patient the area of exposure was about one-half inch square; it is now twice as long and twice as broad. He had seen a number of cases in which there was absorption of bone around the exposed dura. The first case mentioned was particularly unfortunate, for the only symptom present was that of persistent headache with nothing else to guide in the diagnosis of brain abscess. The direct cause of death is very uncertain, there being no evidence of an ependymitis or ensuing leptomeningitis.

## DISCUSSION.

DR. DENCH asked if he had understood correctly that the facial paralysis was on the opposite side and the paresis of the extremities on the same side as the mastoiditis. The question was answered in the affirmative. The speaker then said that when the abscess is below the tentorium one generally finds weakness on the same side. He was inclined to believe the disease a double one. He had analyzed over a hundred cases of cerebral and cerebellar abscess, and in only one case was a cerebral abscess on the same side with paresis of the extremities. This condition is looked for when the abscess is below the tentorium. He advocated making a large exposure if any area of dura is exposed. No matter how carefully one may chisel, the dura may be nicked, or a small spicule of bone may split it, and in such event there is much more apt to be trouble than when a good, free opening is made. He invariably enlarges an accidental exposure in the middle cranial fossa.

DR. GRUENING called attention to the probability of intracranial pressure where the opening became larger in so short a time. It is not at all likely that only the small area of dura exposed is diseased, but that a larger area is affected. For this reason it is better to have a free exposure. It is probable that there were multiple abscesses in the case reported. That would explain the condition of paralysis of the extremities on the same side.

DR. DENCH expressed the opinion that the careful operator does not expose the dura accidentally. Seemingly accidental exposure is always an indication of diseased bone, which is taken away by the instrument. For this reason he advocated a good, wide opening if there is any exposure at all.

DR. ALDERTON agreed with Dr. Dench. One should be very careful, however, in doing the operation in cases of the exanthemata, especially scarlet fever, to guard against exposure of the dura, particularly in the middle cerebral fossa. He always endeavors not to expose the dura if it can be avoided.



DR. ALDERTON spoke of a procedure, undertaken recently, for

**The Retroauricular Opening Sometimes Left After the Mastoid Operation.**

Very ingenious operations have been devised for closing these openings, but it is sometimes difficult to accomplish these because of the delicacy of the layer of tissue from which the flap is made. In the particular case in question the mastoid cells had been thoroughly destroyed and finally covered with epidermis, but a large retroauricular opening persisted. The method employed consisted in making two incisions, one each side of the opening. These incisions met above and below the opening. The anterior incision was then deepened and the skin undermined forward toward the auricle, so as to form a flap. A third incision was made about one-half inch posterior to the incision back of the opening and parallel to it. The skin and tissues down to the periosteum between these two incisions was now undermined and lifted away from the periosteum. Then this sliding flap was stitched by its anterior border to the flap formed by the elevation of the tissues in front of the most anterior incision; first having freshened the angles formed by two anterior incisions and the margins of the retroauricular opening.

**Opening Sinus and Removing Inner Table.**

DR. GRUENING reported the case of a child who had recovered from measles, and who, two weeks later, complained of pain in the ear. The family physician made a very large myringotomy, and the child seemed to improve. A few days later, however, the temperature rose to  $104^{\circ}$ , falling again to normal. This condition lasted four or five days, the family physician finding no symptoms of mastoiditis. Dr. Whiting was called in and pronounced it mastoiditis and probably sinus thrombosis. He advised immediate operation. Dr. Whiting was unable to attend to the case, and the speaker was called in. He found the condition as described. The mastoid was tender at the apex, the chart showed an elevation of temperature, the drum membrane had almost healed, and there was very little swelling of the membrane. When the mastoid was opened a very extensive destructive process was found, ex-



tending back into the occipital bone. The mastoid was pneumatic, and the cells were all filled. The sinus, however, was covered with healthy bone. In this connection he recalled a conversation with Neumann, who said that whenever the cells are exposed it is better to remove the inner table, because it is badly nourished. In accordance with this view the thin bone which covered the sinus was removed and the sinus exposed for about an inch and a half. It looked healthy, so that the jugular was not tied. The child made an uneventful recovery. Granulations sprang up over the sinus wall, much more rapidly than would have been the case had the thin bone been left.

#### DISCUSSION.

DR. DENCH, referring to the remarks of Neumann, quoted by Dr. Gruening, cited a similar case operated upon by himself. When the operation was finished he asked Neumann if he would have performed it in the same way. The reply was that he would, with the exception that he would have removed the thin plate covering the sinus. The child made a good recovery. It is impossible to lay down an invariable rule about removing the inner table.

DR. ALDERTON had seen about two hundred cases in the Kingston Avenue Hospital within the last two years, some of which were very extensively involved, but in all these cases he had seen only two instances of sinus thrombosis. In one case the sinus was perforated accidentally, and it looked as if the sinus thrombosis was the result of the operative procedure.

## NEW YORK OTOLOGICAL SOCIETY.

*Stated Meeting, May 24, 1910.*

DR. ROBERT LEWIS, JR., IN THE CHAIR.

### Gradenigo's Syndrome.

DR. KENEFICK spoke briefly of a case which came into his clinic in November of last year, with otitis media following influenza and developing into acute mastoiditis. There was a large pneumatic mastoid, and the zygomatic cells were involved. Immediately following the operation there occurred paralysis of the internal rectus of the same side. When the patient returned to be dressed it was noticed that an undue amount of pus was escaping from the wound. The entire picture presented was unusual, and it was insisted upon that the patient return to the hospital for observation and operation if necessary. No other symptoms were present. He felt so much better that he insisted upon going home, and disappeared entirely. The man was about forty years of age, his occupation was that of a maker of neckwear. After a number of weeks an investigator was sent from the hospital to see what had become of him. He was found lying in a stupor. He had refused to have anything more to do with surgeons, and his mastoid wound was being dressed by his sister. After ten weeks he returned, with the wound apparently healed, but with pain on pressure posterior to the tip of the mastoid. There was also some pitting on pressure. He submitted to a second operation, when it was found that the tip had not been thoroughly removed at the first, because of the peculiar pneumatic structure of the mastoid, some cells being left very deep beneath the edge of the occipital bone. Otherwise nothing wrong was found. The conditions which followed were none other than could be expected. The patient now comes to the clinic to be dressed, and is apparently all right.

At the time of this last operation a retropharyngeal abscess was discovered and incised. It presented a sinus which admitted a probe upward as far as the base of the skull, its course lying somewhat to the left of the median line.

He is indebted to Dr. Charles E. Perkins of Dr. Dench's clinic for ready access to the literature of the subject, as he recognized the external rectus paralysis as belonging to a class of cases upon which he was at the moment preparing a paper. Without the pharyngeal complication the case falls under a rare class presenting the so-called "Syndrome of Gradenigo," viz., acute mastoiditis, extraordinary parietal and frontal headache, and paralysis of the external rectus. In an experience of nearly fifteen years in the New York Eye and Ear Infirmary, this was the first case of its kind Dr. Kenefick had encountered.

In looking up the subject he found that in all probability the lesion of the sixth nerve could readily occur at a point corresponding with the junction of the petrous tip of the pyramid with the body of the sphenoid bone. How the pus reaches this point is a question which has puzzled the reporters of similar cases, but it would seem most probable, in this case at least, through the petrous portion of the pyramid, which, by the way, is not always petrous, but sometimes cancellous. The postpharyngeal abscess could readily occur by the burrowing of pus through the foramen lacerum medium, and thus come out at once along the pharyngeal surface of the sphenoid body and gravitate behind the pharyngeal muscles of the left side. This will make only the seventh case of its kind on record in the literature, i. e., of cases presenting "Gradenigo's Syndrome" together with retropharyngeal abscess.

DR. GRUENING had seen such cases unattended by pharyngeal abscess. He recalled two cases, one of which died and the other recovered, with paralysis of the abducens. These abscesses may be regarded as safety valves.

#### **Mumps Followed by Deafness.**

DR. E. GRUENING reported a case of mumps with certain interesting complications. The patient, a young lady sixteen years of age, had had mumps four weeks before consulting him. During the course of this affection she became dizzy, had inclination to vomit, and became absolutely deaf in the left ear. The physician whom she consulted at that time said she might take pilocarpin internally, but that she would not be better, and that in his experience these cases never improve. Very thorough examination of the patient revealed the fact

that she was absolutely deaf when tested with the buzzer, but heard the Galton whistle at two millimeters. There was no conduction through the bone. No doubt the condition was due to labyrinthine infection. The patient had all the symptoms of Meniere's disease. She had no symptoms of neuritis.

DR. J. B. RAE asked the speaker if the patient had been rotated. The question was answered in the negative.

DR. EDWARD B. DENCH had seen several cases of labyrinthine disease coming on after mumps, and in such cases had found pilocarpin beneficial. After six months the prognosis is bad, but up to that time the condition should improve under pilocarpin. He thought the buzzer overrated. It is impossible to put the instrument into the ear without getting a certain amount of vibration through the bone. In his opinion, the ear which does not hear with the buzzer on the opposite ear is not necessarily absolutely deaf. It demonstrates a remnant of hearing; it does more than shut out the hearing on the well side. If there is a small residual hearing the buzzer will cut it out absolutely.

DR. HARRIS asked if the caloric test was made. Dr. Gruening replied that it was not.

DR. A. B. DUEL had seen a case in which there was a history of mumps a year previously, followed by symptoms similar to those described by Dr. Gruening, with resultant deafness on the affected side. There was complete loss of hearing and of vestibular reaction to the caloric test, and complete loss of bone conduction. The patient had taken pilocarpin without any effect, but it had not been administered until several months after the onset.

DR. RAE asked Dr. Gruening if this could be a septic neuritis. If so, it must involve both branches of the nerve. There might be hemorrhage in the labyrinth. In neuritis one might expect to find deafness without destruction of the vestibular branch, but the nausea and vomiting point to trouble in the labyrinth, not behind it.

DR. DENCH asked if these cases of mumps are not all retro-labyrinthine and not intralabyrinthine.

DR. GRUENING, in closing the discussion, said the symptoms did not point to involvement of the nerve behind the labyrinth, but to involvement of the labyrinth. He considered such cases hopeless as to restoration of hearing. He thought Dr. Dench too optimistic with reference to pilocarpin.



DR. LUTZ presented a temperature chart in connection with the history of a case of

**Scarlet Fever Otitis**

of seven years' standing. The patient had undergone the mastoid operation at the time, but the ear had continued to discharge. Last January she complained of headache and stiffness of the neck, and there was a rise in temperature. He operated upon her, finding a very necrotic mastoid, but nothing unusual. There was a large pit which had filled in with cicatrix, but the walls of this pit were still suppurating. The patient did very well for a week following this operation; then she had a sudden rise of temperature. The next day one of her knees became involved, apparently with rheumatism, and the salicylates were administered. The ankle and then the hip of the same side became involved, and after several days the shoulder of the other side. He thought he had to deal with a septic case. Upon questioning her he found that she had had frequent attacks of tonsillitis and joint symptoms the year before, and so the conditions were recorded as rheumatism. The temperature continued high, and after using the salicylates and various other remedies, the polyvalent serum was employed. After the second injection the temperature dropped to 97°, running a fairly normal course after that. The patient had had no chills. He wondered if the case was not one of mixed infection, of septic infection in addition to the rheumatism. At any rate, the polyvalent serum, which is a mixture of streptococci, staphylococci and colon bacilli, seemed to be effective in this case, as it is in others of a puzzling nature.

DR. DUEL said all these cases of inflammatory rheumatism, particularly endocarditis, are supposedly of infectious origin. The infection may come from a purulent condition in any part of the body. In a case where there is decided infection in the mastoid or around a large portal of entrance, like a vein, he would certainly think it a case of infection. It is in such cases that one finds bacteremia.

DR. LUTZ added that the temperature would remain at 103 or 104 degrees for a week at a time, not presenting the drops which are to be expected in septic cases. When the patient had severe endocarditis and was absolutely prostrated by it, Dr. Van Cott considered it a straight case of rheumatism.

The polymorphonuclears were 78 per cent, the leucocytosis 18,000 the first time and 12,000 the second.

DR. RAE called attention to the fact that at the meeting of the American Otological Society last year Dr. Halstead, of Buffalo, and the speaker reported cases of so-called rheumatism, both of septic origin. In his own case the doctor who called him in consultation pronounced it rheumatism, while the case proved to be a thrombosis of the sinus. A positive blood culture was obtained. Dr. Halstead's case was very similar.

DR. KENEFICK said that in acute rheumatism following tonsillitis there may be little or no disturbance in the neighboring glands. Acute inflammatory rheumatism involving the joints and later the heart might occur without local manifestation in the throat.

DR. HARRIS said a case was suggested which he had just seen in consultation, where the mischief was done without operation. The patient, a child twelve years old, had the worst endocarditis he had ever seen. He was asked as to the wisdom of removing the tonsils, which were undoubtedly the cause of the trouble. There was no glandular enlargement. Dr. Kerley had seen the case some time previously and thought removal of the tonsils would cause remarkable improvement. The case had been under the care of another physician, who had evidently not watched it very carefully. The patient was up and going to school, and he had not observed the heart condition. This had suggested to the speaker that a similar state of affairs might have existed in Dr. Quinlan's case.

DR. HASKIN called attention to a thesis by Dr. Rosenheim, of Baltimore, published in the *Transactions of the American Laryngological, Rhinological and Otological Society*, in which the ground of rheumatism in connection with the tonsillar ring is very thoroughly covered. The observations were based upon a large number of cases studied in the Johns Hopkins Hospital.

DR. LUTZ called attention to a recent abstract in the *Journal of the American Medical Association*, taken from one of the German journals, in which 87 tonsillectomies in rheumatic patients were reported. In 70 cases there had been no return of the rheumatism.

DR. DENCH, referring to these irregular temperatures, re-

called a case operated upon several years ago for tonsillectomy and adenectomy. The temperature ran from 99 to 101 degrees for about five months. As there was a history of tuberculosis in one branch of the family, naturally the parents were rather alarmed. There was no explanation for the temperature. There had been some enlarged glands, but these disappeared immediately after the operation. The child was seen by a celebrated pediatricist in Munich, whose only advice was to throw away the thermometer, saying children sometimes run a temperature without any cause.

#### **Suspected Brain Abscess.**

DR. ALDERTON detailed the history of a boy, eight years of age, seen by him March 11, 1910. The patient had had an abscess in the left ear, earache, but no discharge. The right ear was normal except that the drum was slightly retracted. In the left ear the posterosuperior wall was sagging. There was tenderness over the mastoid antrum, tip and posterior border. The temperature was 99.1°, the pulse normal. The drum was incised and the appropriate treatment ordered. The patient was instructed to report two days later. He did so, and the temperature not having subsided, he was sent to a private room in the hospital. The mastoid was opened and found to be pretty badly involved, particularly along the vertical row of cells from the antrum down to the tip, which was also involved. This was thoroughly cleared out, and the patient seemed to do very well. The temperature did not fall completely, but staid around 99 to 102 and 103 degrees by mouth. The pulse followed the temperature; the respirations were normal. During this time the patient complained of a little fugitive headache, which seemed to be located over the eyebrow of the operated side. It was thought to be due to the tightness of the bandage. This continued from the 14th to the 30th, when the temperature was 100.2°, pulse 100, and respiration 24. At 12:45 that day the speaker called and found the child in convulsions. The convulsive seizures were on the same side, while the opposite side was paralyzed, spasms of the muscles of the jaw necessitated the use of the mouth gag, and horizontal nystagmus toward the affected side was present. At 2:45 the wound was explored. It looked perfectly healthy, and the ear had ceased to discharge. He thought he had to



deal with meningitis brought on by an extradural collection of pus, which had gone beyond the protective boundaries. He uncovered the temporosphenoidal lobe. The inner table seemed to be softer than it should be, but the dura looked normal, except for a little cloudiness. There were no signs of discoloration. The tegmen was removed pretty thoroughly over the antrum and the tympanum. He uncovered the dura of the cerebellum, also the sigmoid sinus. The dura there seemed normal. After the patient came out of the anesthetic there were no more convulsions for some time. The temperature after the operation ran to  $101\frac{4}{5}^{\circ}$ , the pulse to 108, and the respirations 24. The next day a blood count was made and showed leucocytosis of 18,382, polynuclears 81 per cent. The boy still continued to run a temperature which varied between  $99^{\circ}$  and  $101^{\circ}+$ . The wound was dressed with a moist bichlorid dressing. The temperature fell a little under this treatment. On the fifteenth day after the operation the temperature and pulse went to subnormal, the respirations 26. There was nausea and vomiting, and some headache. A neurologist was called in consultation, and was sure that the original attack previous to the second operation was beginning meningitis and that now a brain abscess had to be dealt with. He recommended an exploratory operation. This was refused by the child's parents, who preferred waiting a while before having so serious an operation performed. The child continued to have headache, and once or twice convulsive seizures, some nausea and vomiting, and he looked badly for a while. Because of the objections of the parents no operative treatment was instituted. Gradually all the symptoms disappeared. On April 30 there was a temperature of  $98\frac{3}{5}^{\circ}$ , pulse around 100, respirations 22, the headache, nausea, vomiting, and all other symptoms of cerebral involvement had disappeared. Another blood count showed leucocytosis of 28,000, polynuclears 65%. The pupils responded normally to light. There was a suggestion of beginning optic neuritis. The wound healed, and so far as physical signs are concerned the child's condition returned to normal. No lumbar puncture was made and there was no specific history.

DR. HASKIN cited a case at the Manhattan Eye, Ear and Throat Hospital. The patient entered the hospital complaining of an intense pain in the cerebellar region. Careful exam-



ination was made and all the tests applied with reference to hearing, nystagmus, blood counts, etc. From the negative findings everything was excluded but cerebellar abscess. There was dizziness, explosive vomiting, and choked disk on the right side. The patient denied any specific history. It was finally decided to operate and the field was uncovered. In the mastoid there was found a little softening of the bone but no pus. The posterior and middle fossæ were uncovered, but no evidence whatever was found of meningeal trouble. The wound was closed and the patient did very well. Several days after operation a rash was discovered—a typical secondary rash. A positive Noguchi reaction was obtained. The patient finally was made to acknowledge that he had had a primary lesion and mercurial treatment ordered.

DR. DENCH related an interesting experience with an Arctic explorer who had a profuse external otitis. The otitis cleared up, and the patient was practically all right for a year. He had had a chronic nonsuppurative inflammation in both ears, which caused deafness. After a year he returned, complaining of headache, nausea and projectile vomiting. He denied syphilis. Brain abscess was suggested by a number of the staff. A positive Noguchi was obtained, and the patient was put upon the iodides, 360 grains in 24 hours being given. He was given mercury hypodermatically, and the condition cleared up absolutely. He had beginning neuroretinitis.

DR. GRUENING said when the mastoid operation had been performed and later brain symptoms showed themselves there was too apt to be a tendency to connect the two. He had had such a case two years ago. A woman had been operated upon for mastoiditis and had recovered. She subsequently came to the hospital with high temperature, great dizziness and vomiting. She was referred to the ear department. The probability of meningitis and of brain abscess was thought of, then various tests were made, among them the Widal, and it was found that she had typhoid fever. She was admitted to the medical ward, where she was treated for typhoid fever, from which she recovered.

DR. DENCH asked how long the paralysis of the right side lasted. This case suggested one upon which he operated at St. Luke's Hospital last year. The Kernig and Babinski signs were well marked in the instance cited. Double mastoidectomy

tomy was performed, exposing a large area over the cerebellum. The cerebellar symptoms disappeared after simple exposure. Not infrequently simple exposure causes sufficient decompression to induce recession of the inflammatory process.

DR. HASKIN said undoubtedly many cases of meningitis do recover. He cited a case under the care of Dr. Dwyer, in which there was pansinusitis, in which the jugular was tied, and the child reported to be in a dying condition. Dr. Collins and Dr. Zabrisky both diagnosed the case as meningitis and in a dying condition. The child recovered completely. The Hiss serum was given in this case, and, despite the child's serious condition, it reacted and recovered.

DR. ALDERTON, in closing the discussion, said the paralysis of the right side, of which Dr. Dench asked, cleared up entirely after the anesthesia for the second operation. The case was investigated very thoroughly by the neurologist at the Brooklyn Eye and Ear Hospital, all the various tests being made. The patient was only eight years old, and, naturally enough, any specific trouble would have been hereditary. The cases reported by the other speakers were hardly parallel. He had had a similar case several years ago, in which the patient was paralyzed on one side after a double mastoidectomy. He explored the brain, but found nothing. The patient recovered. It reminded him of the cases of encephalitis reported by Abbe. The labyrinth was not explored. The nystagmus cleared up immediately after the anesthetic.

#### **Mastoiditis Resembling Otitis Externa.**

DR. DUEL reported a case which was admitted to his service at the Manhattan Eye, Ear and Throat Hospital, in which it was difficult to determine whether there was mastoiditis in addition to a diffuse external otitis. The patient was a man in the early twenties, with a history of earache and swelling of the external canal and surrounding tissues of the ear for ten days. On inspection the usual symptoms of diffuse external otitis were found. There was marked tenderness in front of the tragus, posterior swelling, and some swelling between the mastoid tip and the angle of the jaw. It was impossible to determine whether there was any deep tenderness over any part of the mastoid in which this edema existed, owing to the

fact that the superficial tenderness was so prominent. The canal was much swollen, but not to such an extent as to prevent the introduction of a small speculum. There had been a slight discharge, but it was impossible to tell whether the secretion came from behind the drum or not. It was also impossible to determine the presence or absence of a perforation of the drum membrane. The temperature was 101.6°. The house surgeon operated under the speaker's direction, the patient being prepared for the mastoid operation, should this be found necessary. The fact that there was tenderness far back over the mastoid emissary vein, away from the region of the edema, caused him to decide upon the mastoid operation. He advised a short posterior incision in the line in which it would be made for an acute mastoid operation, and the pushing forward of the periosteum. This was done, and the swelling behind the ear was found to be simply edema. There was no subperiosteal pus. Deep pressure between the mastoid tip and the angle of the jaw caused a pouring out of about two drams of thick, creamy pus from the external meatus. The periosteum was then pushed forward and, without stripping it posteriorly, the operator penetrated the cortex directly over the mastoid antrum. After removing the cortex the superficial cells looked healthy. Owing to the fact that there were no external evidences of pus, he advised going on into the antrum, and; as soon as the curette entered the small opening into the antrum, about an ounce of thick pus welled up from the mastoid. The incision was then enlarged and prepared as far as an acute mastoid operation. The periosteum was stripped upward. On removal of the tip and mastoid cortex a large perisinus abscess was found. The granulations extended from about one-half inch above the knee down to the bulb region. There was also a Bezold perforation of the tip. This was washed out. The temperature dropped to normal, and the patient is apparently going on to recovery. He had seen cases with just as much swelling of the soft tissues in which there was nothing but a diffuse external otitis with broken down glands in this region.



DR. HARRIS said there have been reported from time to time cases of

**Transient Middle Ear Infection With More or Less Destruction of the Mastoid**

found upon operation. In line with these cases he wished to make a preliminary report of a case under his care at the present time.

Four weeks ago a young woman, about thirty years of age, was sent to him for examination. She looked very well and was rosy-cheeked, but complained of a great deal of pain in the head, referred to the back of the head in the occipital region and extending over the parietal region of either side. There was pain in the ears and pain over the mastoid. Pressure over the back of the head elicited pain; pressure over the mastoid and beneath the mastoid of either side also elicited pain. There was also pain in front of the ear. Examination of the ear drums was entirely negative, both being perfectly normal. There was no swelling over or below the mastoids. The temperature was normal; the nose and throat were normal. He felt quite positive that there was no mastoid involvement, and considered the condition either neurotic or rheumatic. Large doses of aspirin were given, with some benefit. The patient went on with her work. In connection with the aspirin he gave large doses of iodid of potash. Every time she took it she had pain in both ears. Still feeling that he had to deal with a noninflammatory condition of the mastoid, he put a fly blister over it. All the pain disappeared. On account of the complaint of pressure he inflated the ears, with no benefit. There was a little catarrhal swelling of the tubes. He dismissed the case, as there seemed to be nothing but a neurosis. A week ago she returned, saying all the pain had recurred. There was more extensive tenderness over the mastoid tip on the left side. There was still absolutely nothing in the fundus of the drum or in the canal. The patient entered the hospital on Saturday, and in a more or less empirical way he put on an ice coil, and ordered sol. Magendie, if there was much pain at night. She still complained of pain, so much so, in fact, that she could not swallow solid food, nor could she masticate food. The temperature was virtually normal, pulse and respiration normal. The blood examination



was not satisfactory. The report said there was a leucocytosis of 9,000 and a polynucleosis of 46 per cent, which the pathologist insisted was right. There was no history of discharge from the ear, no peculiar onset of the pain, so that she could point to a certain day on which she had earache. The hearing is normal. She had had no vertigo except since she entered the hospital and had been taking large doses of quinin. She had had some fugitive chills, and the thought of malaria presented itself. The plasmodium was not looked for. There was no history of rheumatism. The pain over the mastoids was intense, especially over the left, and was not in one spot, but over the whole cortex. The pain had continued for four weeks, and he proposed to explore the mastoid and see if the explanation for it could be found there.

DR. BERENS had had a case with a very similar history. Dr. Gruening and the late Dr. Bull both saw the case. The pain finally became so severe that the mastoid on one side was opened. There had been no history of ear trouble other than this pain, nor had there been any elevation of temperature. The mastoid was found to be full of very large air spaces, and in these spaces were evidences of osteophytic deposits in the form of stalagmites and stalactites. The patient made an uninterrupted recovery on that side, and the pain grew so intense on the other side that that was finally operated upon. This was also found to be full of large air spaces and typical osteophytic deposits. There was no history of an ear discharge at any time in the girl's life. She died suddenly two or three years later, and some cerebral lesion was suspected. The brain was thoroughly examined and nothing found. The mastoids were examined, and the wounds found to be filled with normal cicatricial tissue. There was no recurrence of the pain following the operation.

DR. HASKIN had operated upon a similar case and had found similar conditions to those described by Dr. Berens. The mastoid was absolutely dry and sclerotic, with no inflammatory condition and no pus. The mastoid bone cavity was filled with paraffin and sewed over. The patient made a rapid recovery, left the hospital in four or five days, and never had a return of the pain.

DR. DUEL reported a case in which there was continuous pain and tenderness over the mastoid with an apparently nor-

mal drum. There was no history of a discharge from the ear. The hearing was good. The mastoid was opened and found to be filled with greenish-yellow pus.

DR. DENCH said pain such as that described by Dr. Harris had been explained as due to inflammation of the geniculate ganglion. This was Hunt's explanation. Dr. Taylor had operated upon one or two cases for resection of the nerve of Wrisberg, with complete relief of the pain. He has seen more than one case of this kind in neurotic women, and had always considered them as some form of neuritis.

DR. BERENS thought the case to which he had referred would have been cured by Hunt's operation. He called attention to the fact that there may be mastoiditis without involvement of the middle ear.

DR. GRUENING said Dr. Knapp had reported a number of cases of the kind under discussion in which, upon operation, he found nothing but a sclerotic mastoid, and in which the pain stopped after operation. Many years ago the speaker had had a case exactly like that described by Dr. Harris. The patient was a neurotic individual in the German Hospital, who had occupied a bed near a patient who had been operated upon for mastoiditis. After his neighbor's operation the patient complained of pain in the mastoid. So persistently did he complain that finally the mastoid was opened, and for the first time the speaker had the privilege of seeing a perfectly normal mastoid in the living subject.

DR. KENEFFICK called attention to the fact that pain such as that described by Dr. Harris may have its origin in the mouth. He cited a case in which a capped tooth was the source of the trouble, and emphasized the importance of a careful examination of the teeth in such cases.

## ABSTRACTS FROM CURRENT OTOLOGIC, RHINOLOGIC AND LARYNGOLOGIC LITERATURE.

### I.—EAR.

#### **The Treatment of Acute Purulent Middle Ear Inflammation With Bier's Hyperemia Method.**

SPIRA (*Monat. für Ohrenheilkunde*, Vol. 44, pp. 289, 1910). This method of treatment, which the reviewer had formerly compared in safety to a dynamite cartridge in the hands of the small boy, is again revived, this time from Russia. As usual, one or two cases are instanced, and the careful investigations of the unbiased German school are not considered. As usual, also, the brilliant remark is made that it should not be used in the presence of intracranial complications.

*Horn.*

#### **Postoperative Labyrinthitis.**

BONDY (*Monat. für Ohrenheilkunde*, Vol. 44). Detailed report of a case in which, following an ordinary radical operation, with an absolutely intact labyrinth, the patient two days after the operation showed symptoms of a purulent labyrinthitis without fever. The patient refused operation, and the symptoms rapidly cleared up for two days, when meningeal irritation manifested itself. The Neumann radical labyrinth operation was done, but the patient died of a purulent labyrinthitis. The discussion brings out the necessity of a careful distinction between serous labyrinthitis, where we need not operate, and purulent labyrinthitis, where the Neumann operation must be carried out without a moment's delay.

*Horn.*

#### **The Treatment of Tinnitus Aurium.**

BARR (*British Med. Jour.*, October 16, 1909), in his paper, at the recent meeting of the British Medical Association, reviewing the subject, was exceedingly discouraging, and added nothing new to our knowledge of the subject. He condemns Siebenmann's treatment with phosphorus, for the alleviation of otosclerosis, although he has never had any personal experience with it. A general hygienic treatment, with removal to

a more favorable climate, is all that he suggests. The surgical treatment of this trouble was handled by Lake, in the same journal, who seems to consider Babinski's results as not warranted and warns against the use of lumbar puncture.

His results in ossiculectomy have been unfavorable, and he considers the procedure of little use. His operations for the destruction of the entire labyrinth have also been unsuccessful, but he thinks the matter will bear further investigation. The ligation of the carotid he considers quite indefensible. The statistics on the division of the auditory nerve within the skull have resulted in 8 cases in 3 deaths, 2 failures and 3 successes. He considers the operation entirely unjustifiable.

*Horn.*

#### **Inflammation of the Labyrinth and the Labyrinth Operation.**

RUTTIN (*Monat. für Ohrenheilkunde*, Vol. 44, p. 459, 1910) reports 100 cases of labyrinthitis which he had the opportunity of observing at the Vienna Clinic in the last two and one-half years. Briefly the indications for operation are as follows: In the presence of one or more signs of physiologic activity of the labyrinth (hearing, reaction to heat and cold, reaction on turning, absence of fistula symptom) the radical operation alone is carried out. If after the radical operation the clinical tests show that these labyrinthine functions have ceased the radical labyrinth operation is carried out in a second sitting. If there is a total absence of the labyrinth function at the first examination, then the radical mastoid and the labyrinth operation are done at the same time. Of the 100 cases, 53 were classified as circumscribed purulent labyrinthitis, and 47 as diffuse purulent labyrinthitis.

Of the 53 circumscribed cases, the radical mastoid alone was done 35 times. The labyrinth operation was done at the first sitting in 13 cases and at a second sitting in 5 cases. In the group of 35, 34 recovered and one died of tubercular meningitis. In the group of 5 cases where the labyrinth operation was carried out at a second sitting, three recovered and two died from brain abscess. Of the 13 cases of primary labyrinth operation, 9 recovered and 4 died. (Meningitis before the operation, 1 case; meningitis after the operation, 1 case; brain abscess, 2 cases.)

Of the 47 diffuse cases, 13 are classified as manifest, 34 are



classified as latent. All had the labyrinth operation performed. Of the manifest cases, 6 recovered, 7 died. (All with meningitis before the operation.) Of the 34 latent cases, 26 recovered, 8 died. (Meningitis before the operation, 4; tubercular meningitis, 1; brain abscess, 3.) In other words, only one death could be charged to the labyrinth operation, an operative mortality of 1%.  
*Horn.*

#### Attic Suppuration.

MILTON J. BALLIN (*New York Medical Journal*, November 6, 1909) urges more attention to the intratympanic operative procedure for the treatment of chronic middle ear suppuration. Cases in which the best results have been obtained are those in which the pathologic condition was confined to the attic, without too extensive changes in the osseous walls. He regards suppuration of the attic the causal factor in the great majority of cases in keeping up the purulent discharge from the ear. Attic suppuration may be divided, first, into those associated conjointly with a middle ear affection, and second, those developing independently and at all times localized and associated with a perforation in Schrapnell's membrane. In the treatment of attic suppuration Ballin has had the best results with the use of peroxide of hydrogen instilled into the ear. In certain cases solution of alcohol and boric acid has worked well. Where instillations do not have any effect he uses 2% solution of alcohol and boric acid injected with a Hartmann canula into the attic. In obstinate cases removal of the incus and malleus, together with at times the upper wall of the attic, will be necessary, and in the author's hands is wont to give satisfactory results. He reserves the radical operation on the mastoid for such cases as fail to be cured by this procedure.  
*Harris.*

#### After-Treatment of the Radical Operation Without the Use of Tampons.

ISEMER (*Archiv. für Ohrenheilkunde*, Vol. 80, p. 125) in the clinic at Schwartz treated 14 cases of radical operation without introducing any tampons. The method pursued was to remove all the dressing at the end of seven or eight days after the operation and to substitute only a narrow strip of gauze in the external canal and in the posterior auricular

wound for the purpose of taking up the secretions. The report of eleven of these cases is given in full. In only two of the fourteen was there an epidermatization and healing. Usually in three weeks pronounced granulation took place with increased secretion. The contour of the operative field was lost, and it was impossible to get any view into the depths of the wound. At the end of five weeks contractions of these granulations took place, and membranous bands were thrown out. These bands were of two forms, one lying in front of the antrum, shutting off the aditus, leaving in this way a large pocket for holding pus, the other membrane, with a small perforation on its upper portion completely shutting off the middle ear. The author, from his experiences in these cases, regards the procedure as in every way disadvantageous and without merit. He points out that the value of the introduction of tampons lies first in their ability to take up the secretions of the wound, and second, their preservation of the form of the cavity and prevention of adhesion arising from granulations.

Harris.

#### Endoscopy of the Pharyngeal Mouth of the Eustachian Tube.

MAYR (*Archiv. für Ohrenheilkunde*, Vol. 80, p. 192) reports two cases illustrating the value of the direct examination of the pharyngeal opening of the eustachian tube. The first was a youth of 17, who complained of nasal obstruction and pressure in both ears. A diagnosis of chronic hypertrophic rhinitis and pharyngitis was made. Both drums were retracted and thickened. Catheterization of the left tube was easy, but the smallest instrument could not be passed on the right side. Posterior rhinoscopy did not explain the difficulty. The employment of the endoscope, however, revealed a half moon, grayish membrane stretching between the anterior and posterior tubal prominences and tightened by the act of swallowing. A strong, curved sound was employed to break the membrane after preliminary cocaineization. There was no return of the membrane after six months.

The second case was a man of 28, who complained of difficulty of hearing with tinnitus in both ears and irritation in the throat. Both drum membranes were thickened and retracted. Posterior endoscopy showed the remains of adenoid tissue. Catheterization of both ears was easy, but was immediately fol-

lowed by brisk bleeding from the nasopharynx, which was easily controlled. The source was not discernible, although the rhinoscopic mirror suggested that it was proceeding from the right choana. Two days afterward Mayr made a direct examination and discovered on the floor of the mouth of the right tube a swelling 3 to 4 mm. high resembling a papilloma, touching of which caused bleeding. Under endoscopic control this was touched with the galvanic cautery without any reaction. Six months later the mouth of the tube was found normal.

The author argues that these two cases demonstrate that the endoscope is not a toy, but is an instrument of actual diagnostic and therapeutic value. He employed an endoscope made by Reiniger. [The abstractor is not acquainted with this particular instrument, but should expect that the pharyngoscope recently invented by Hays would prove satisfactory in every way.]

Harris.

**Two Unusual Cases of Otitic Sinus Thrombosis. Operation.  
Recovery.**

HUGH B. BLACKWELL (*New York Medical Journal*, February 5, 1910) reports two cases of sinus thrombosis depending on ear disease, presenting several atypical features. In the first case, a boy of six, there was a history of discharge from the ear for the last five years. Two weeks before admission to the hospital the ear ceased to discharge. This was associated with pain in the head and throat. Later the discharge returned. One week before coming to the hospital the patient had a chill, which was repeated nightly for six nights. The patient at the time of admission appeared decidedly septic. Edema over the mastoid with tenderness was present. The cells were found broken down and filled with pus and granulation tissue. No trace of the structure of the sigmoid sinus was present. The course of the lateral sinus was followed backward one and a half inches to the knee, where the vein appeared normal and was opened. The removal of the clot found here was followed by a gush of blood. No bleeding followed the curetting of the jugular bulb. The vein was then excised in its entire extent. There was prompt and uninterrupted recovery.

Attention is called to the apparent absence of symptoms,



either local or general, pointing to sinus involvement until a cortical perforation of the mastoid process was imminent. Owing to the entire destruction of the sigmoid and portions of the lateral sinus, as revealed at the time of the primary operation, it would appear that there had been a thrombosis for a period of at least several weeks.

The second case, also a boy of six, was operated on 72 hours after the initial earache. There was an extensive clot in the lateral sinus. There being no return of the blood through the jugular bulb, the right jugular vein was excised.

The author calls attention to the unreliability of the symptoms indicating the beginning of a sinus thrombosis and the importance of thoroughly exposing and inspecting the walls of the sinus in all cases of mastoiditis where the operator has the slightest reason for suspecting a sinus involvement. He urges the importance of operative celerity in such cases. In neither of these cases was any attempt made to perform a formal mastoid operation.

Harris.

#### The Employment of Hot Air in Otology.

COME FERRAN (*Journal of Laryngology*, August, 1909). In affection of the middle ear catheterization by means of hot air has given such good results in the author's hands that he feels a report is of value, even if he has no new facts to offer. He has, however, modified the apparatus to "a simple Politzer bag prolonged by an aluminum neck containing an electrical resistance." This is easily managed and sufficiently light not to make catheterization painful to the patient.

The unhappily numerous cases of pure otosclerosis have been little influenced by the treatment, but in many other cases, especially those of tubal catarrh, the results obtained have been far better than by any other method. The action of hot air in certain cases was found to be more rapid than ordinary catheterization. Indeed Ferran reports cases where a return to normal hearing resulted after this treatment, whereas only slight improvement had been obtained before.

The author believes that the benefit, aside from the mechanical effect of hot air, lies in the modifying of the condition of the mucous membrane, and speaks of seeing frequently, though not always, when examining rhinoscopically before and



after inflations of hot air, contractions of the mucosa similar to that seen after painting with cocain or adrenalin.

The use of hot air is only contraindicated in cases where labyrinthitis is suspected. Otherwise it is harmless if only moderate heat is used. *Harris.*

**Anesthesia of the External Auditory Canal and Drum Membrane by Chlorid of Ethyl with Speculum Permitting of the Instantaneous Evaporation of the Chlorid of Ethyl.**

KOENIG, Paris (*Revue Hebdomadaire*, November 6, 1909). This is the application of the method first described by Schild of Baltimore some six years ago. On account of certain unsatisfactory features of Bonain mixture (menthol, carbolic acid and cocain), the author has recently employed, with good results, ethyl-chlorid to anesthetize the drum membrane. He has made use of it in a number of cases and says that its employment is free from any drawbacks. It is particularly indicated for paracentesis. He has modified Schild's apparatus so that instantaneous anesthesia is obtainable. This consists of an aural speculum provided with a narrow canal running its entire length and terminating on the edge by a slight elevation, to which is attached a fine rubber tube 20 cm. long. At the end of this tube is a small glass tube for the mouth of the operator. By means of this the Politzer bag employed by Schild can be dispensed with. One can insufflate with air at the same time that he introduces the jet of chlorid of ethyl. This is instantaneously evaporated, producing immediate anesthesia of the tympanum. No assistant is required, and the entire operation can be completed in ten seconds. *Harris.*

**A Study of Galvanic Nystagmus by Means of the Nystagmograph.**

BUYS (*Monats. für Ohrenheilkunde und Laryngo-Rhinologie*, 1909, Vol. 43, p. 801) says that galvanic nystagmus is either completely rotatory in type or almost so. Nevertheless, he found it able to record the movements with his nystagmograph. He says that the apparatus is either much more sensitive than the usual methods of observation, or else the movements with the closed eye is greater than with the open eye, because he found that three mil-amperes showed distinct record on the nystagmograph, while it required at least 10 mil-amperes to cause movements sufficient for ocular inspection.

*Wood.*

**Disturbance of Taste in Middle Ear Disease.**

SCHULZ (*Arch. f. Ohrenh.*, Bd. 79, 1909, p. 220) made a careful study of 55 patients with different forms of middle ear disease. He found that in 39 cases of chronic suppuration of the middle ear six showed no disturbances of taste, and in no case was the function absolutely abolished. There was some perversion and loss for certain tastes, most frequently for sour, then came bitter and salt, while the perception of sweet was seldom destroyed. When the chorda tympani nerve was destroyed by operation complete ageusia resulted, as in excision of the malleus and incus. If the nerve was severed the loss of taste was permanent. Perversion of taste did not occur in operative cases. In acute suppuration there were no cases of complete ageusia, and in two cases no disturbance of taste could be detected. In only one case of chronic catarrhal otitis media could any disturbance of taste be discovered.

Wood.

**Cosmetic Treatment of Paralysis of the Facial Nerve.**

BUSCH (*Beiträge zur Anatomie, Physiologie, Pathologie, etc.*, Vol. 3, 1910, p. 380) proposes to overcome the deformity in cases of Bell's palsy of otitic origin by the suspension of the angle of the mouth. His method of operation is as follows:

Under local anesthesia an incision is made about two cm. long, just beneath the lower edge of the zygoma, and it is carried down to and through the periosteum. A second incision about one cm. long is made about a half cm. above and parallel with the angle of the mouth. A suture of aluminum bronze is carried from the upper wound through the periosteum of the zygoma and out the wound above the angle of the mouth, care being taken that the suture does not penetrate through the mucous membrane of the mouth. The suture is passed upward, just posterior to its position when it was brought down, and emerges once more at the upper incision. On tightening this suture the angle of the mouth will be elevated. The deformity should be over corrected. After fastening the suture the two small skin wounds are united and dressed with collodium. Busch claims that the cosmetic result of this operation is very satisfactory and that the wire suture does not give any inconvenience. Of course, the operation does not restore muscular activity.

Wood.

**Contribution to the Symptomatology and Pathologic Histology of  
Fistula of the Labyrinth.**

RUTTIN (*Monats. für Ohrenh. und Laryngo-Rhinologie*, XLIII, Jahrg., 2 Heft, 1909, p. 121) reports 16 cases of fistula of the labyrinth, one of which was carefully examined histologically. A clinical diagnosis of fistula was made by alternately compressing and aspirating the air in the external auditory canal, and noting the associated movements of the eyes. The patient whose ear was examined histologically was 51 years old and had had otorrhea without pain and without known cause for four to five years. For three years he had had very marked deafness. He had been dizzy for two days, with a tendency to turn towards the left, and for the past year had had slight attacks of dizziness, off and on. There was spontaneous rotary nystagmus, which was greater towards the left than towards the right. The caloric reaction of Barany was typical. A few days before death from tuberculosis there was a complete left-sided facial paralysis. The histologic examination showed that there was a fistula in the neighborhood of the inferior edge of the foot plate of the stapes. *Wood.*

**Congenital Syphilitic Disease of the Ear.**

FRASER (*Journal of Laryngology*, August, 1909). After reviewing the theories of various authorities as to causative conditions in congenital specific deafness, the author goes on to his report of 33 cases observed during a period of twenty-eight months. The examinations and corroborations were as thorough as possible under the difficulties of such investigation. Aside from a detailed report of each case the whole is carefully tabulated as to results in regard to:

Age—More than half between ages of 6 and 15.

Sex—Generally stated that females are more often affected; no striking preponderance of females here.

Position of Patient in Family—Nearly half were eldest or only child.

Mode of Onset—In some gradual, others sudden. History of tinnitus giddiness varied.

Condition of Teeth and Eyes—Interstitial keratitis was present in all but one.

Condition of Patient at Time of Examination—Nineteen complained of tinnitus, 12 suffered from occasional giddiness. The amount of hearing was remarkable in a large number.



Otoscopic Appearance—Large percentage showed signs of tubotympanic catarrh. Condition resembles eustachian obstruction; mistake in diagnosis easy.

Tuning-fork Tests—Galton whistle was heard up to almost the upper tone-limit in a remarkable number of cases, and the middle and upper tone forks were heard by more than half of those examined.

Vestibular Irritability—The condition of the cochlear and vestibular apparatus was found to correspond.

Facies of Patient: Condition of Nose and Pharynx—Of 15 examined, 8 were regarded as typical.

Treatment.—Prognosis in cases of long standing is hopeless, the only chance lies in the general practitioner making correct diagnosis and commencing treatment at once. *Harris.*

#### Various Points in the Technic of the Radical Operation on the Middle Ear.

W. LANGE (*Beit. z. Anat. Phys., etc., des Ohres., der Nase und des Halses*, Bd. III, 1909, p. 170-216) in this article goes over the various points in the technic of the radical operation which seem to him important in obtaining rapid and permanent healing. He says that the best guarantee for a permanent cure of a middle ear suppuration is the radical operation, which, when healed, presents an epidermatized cavity approximately the size of the original operation wound, and which can be fully inspected through the external canal. He condemns too large an incision and says that one beginning not higher than the upper edge of the insertion of the pinna and running down to the point of the mastoid process is sufficiently large to give all the room required for the ordinary radical operation. More room may be obtained when necessary by a horizontal cut running backward from the middle of the original incision. The bone wound must be made sufficiently large so that the antrum and cells are all completely opened up and no overhanging ledges left. If the hypotympanum is not diseased, it has been his custom in recent years to leave it undisturbed. It is important to remove a small portion of bone from around the opening of the eustachian tube, as this is the best method of securing permanent occlusion of its lumen. A patulous tube is very apt to cause reappearance of a mucoid discharge during attacks of coryza or nasopharyngeal congestions. In cases of chronic mastoid suppuration,



where the process in the tympanum is healthy, or has apparently healed, for instance, when the drum membrane is firmly adherent to the internal wall of the cavity, quicker healing will take place if the tympanum itself is left alone. But the malleus and incus, if present, should always be removed. As a rule, during the free removal of bone and the opening of the various pneumatic spaces, the mucous membrane is also taken away. Should small particles be left behind, generally no harm results. Occasionally, however, by rapid growth they cover the surface with mucous membrane, or give rise to retention cysts. When cholesteatoma is present it is best to remove the lining matrix.

Lange is very strong in his belief as to the value of primary closure of the retroauricular wound. It should always be done except when there are actually inflammatory changes in the soft tissues or when labyrinthine or intracranial complications are present or suspected. In children under ten years it may be advisable to keep the external wound open. In cases of tuberculosis, Lange advocates the primary suture. As to the plastic treatment of the external canal, Panse's or Schwartze's methods give very good results, the latter especially when the bone wound has been very extensive. Perhaps a more generally useful method is to make the longitudinal incision of the canal oblique, running from within and below, outward and upward. After cleansing the wound and the removal of loosened particles of bone or free ends of soft tissue, the cavity should be carefully and rather firmly packed, preferably with iodoform gauze. If no untoward symptoms developed the first packing should remain for eight days, though the external dressing must be changed in three or four days. When the granulations are growing rapidly the wound should be lightly but carefully packed with gauze strip preferably impregnated with some antiseptic powder other than iodoform. Excessive granulations should be cauterized or removed. Lange does not approve of the no-packing method of treatment in the radical operation.

The transplantation of epidermis is, as a rule, not necessary, but Thiersch's flaps may sometimes be advantageously applied to carefully prepared granulating surfaces. Although the secretion may have ceased and the complete epidermatization of the cavity have taken place, positive judgment as to the final outcome cannot be made under three months. The cavity

should then show either of the three following conditions: First, a firm, smooth epidermatization of the entire space, including the tympanum and closure of the tube. Second, epidermatization of the cavity, with exception of smaller or greater portions of the tympanum in which the mucous membrane is still present. The tube in these cases may be either open or shut by a thin membrane. Third, spreading of the epithelium of the mucous membrane over larger areas of the wound cavity until maybe the whole cavity is almost completely lined. Good results are obtained, even when a large part of the cavity is covered with mucous membrane, provided that this cavity can be easily inspected. However, occasionally small cysts develop and sometimes rather large retention cysts, which later occasionally resemble blood extravasations or varices of the dura, and if in the right position sometimes suggest the lateral sinus. There are a few cases which require a year or more before complete cessation of the discharge takes place. In those cases in which a complete cure is not accomplished the radical operation is of value, because it makes the ear condition absolutely safe, as far as dangerous or fatal complications are concerned. Although retroauricular openings are not dangerous, and under certain circumstances justifiable, the secondary closure is, however, of distinct advantage, and this can best be done by some form of plastic operation. If the opening behind the ear is closed it is necessary that there should be a good wide opening through the auditory canal, otherwise there will be insufficient drainage of the mastoid cavity.

*Wood.*

#### **Rotation Irritations.**

W. MULDER. Experiments were made with van Rossem's apparatus. They consisted of periodic stopping of a rotation. (1) If periods of about two seconds are taken one feels rotation and after-sensation alternately, with increase and decrease. (2) Somewhat shorter: motion to and fro. (3) Still shorter, e. g., with rotation velocity 20' per sec., and intermission of 0.4 sec., cessation. A mechanical explanation cannot be accepted. Fatigue plays a small part, as the illusion is better felt after some duration of the experiment. It is analogous to the experiment of Helmholtz, where a gray or glittering sensation is observed when the rotating disk is

divided into white and black sectors. Gray corresponds with the cessation in experiment 3, glittering with the motion to and fro in experiment 2. Stronger illumination needs more interruptions per second of the white, so with greater rotation velocity more stops per second are necessary. Fatigue in both cases favors the fusion. The very slow decrease of the rotation sensation was known; following Fick (with the retinal phenomenon) we must also accept an increase of the excitation condition after the stopping of the irritation. What is mixture in Helmholtz's experiment is here neutralization, as the components are respectively positive and negative.

Struycken asked if the second irritation, which followed the first, proceeds in exactly the same way. The experiment is made with some jerks. The head is held eccentric.

Mulder stated that the second irritation proceeds as the first, anyhow that it lasts as long. The course of both is not exactly known. The jerking and shaking of the static organ is certainly a difficulty which should be remedied as much as possible. The eccentricity seemed to be no hindrance in van Rossem's experiments, from computations. *Blaauw.*

#### **Treatment of Meniere's Disease.**

DR. MOLL could not accept the conclusion of Ten Siethoff that his cures showed that no serious affection of the semi-circular canals could have been present. Menière's disease without aural symptoms does not exist. Recovery from dizziness due to middle ear affection through nasal treatment is not caused by reflex, but by disappearance of swelling in the eustachian tube. The theory of Mach-Breuer explains the whole picture. He does not deny that reflexes can play some role. He could not admit true sclerosis in the cases related by Ten Siethoff with recovery from or amelioration of deafness, but regards them as cases of middle ear catarrh. Of course in every case the nose should be carefully examined.

Dr. Ten Cate reported three cases where nose treatment influenced strikingly the symptoms of Menière's disease. (1) A man who suffered for years with attacks of dizziness and noises in the ears, often combined with nausea and vomiting. As long as he can remember he has been somewhat hard of hearing. Drums perfectly normal; tuning fork examination pointed to labyrinthine deafness. Postrhinoscopically, very



great swelling of the posterior parts of the lower conchæ, which were removed. Since then no attack (half a year), the noises and deafness not better. (2) A deflection of the septum was present; after removal no more attacks (three months). (3) Policlinic patient for years under treatment for chronic otorrhea of both ears. He was often dizzy. Since two years, attacks of dizziness with loud noises and vomiting. He often falls during an attack, which lasts from a quarter to half an hour, and ends with a profuse perspiration. The tuning fork shows a combination with labyrinthine deafness, namely, marked diminution of the bone conduction. A large spina septi was found, removal of which caused the spells to disappear for half a year.

Dr. van Dusseldorp reported a similar case. In September, 1907, a gentleman presented himself, suffering for three months with dizzy spells, noises and diminished hearing. He had sensation of turning from right to left; nausea ushers in the attack. After the first attack, the noise and loss of hearing set in, which remained the same. He was entirely well up to three months ago. Drums normal; no tubal or middle ear catarrh. Whisper voice right at 3.5 meters; left at 1.5 m. C. (128 v.) is not perceived by bone conduction, either right or left. Air conduction gives for C. right 45 sec.; left, 25; for  $c^4$  right 15 sec., left 20 sec. (for normal C. through air 75 sec.,  $c^4$  30 sec.). On both sides, swelling of the tuberculum septi, especially left; very painful on touch. This left side was treated with the galvanocautery. Forty-eight hours later patient was free from his complaints; no more dizziness, no noises, no deafness. Whisper voice: right 4 m., left 6 m. C. at the left mastoid, 16 sec.; not perceived, right. For air: right, 28 sec., left 35 sec.;  $c^4$ , right 30, left 28 sec. On November 1 again complains of noises and deafness, since a week; dizziness had not returned. The right nasal side was treated as the left; 24 hours later disappearance of noises and deafness; hearing of both sides 6 m.

Prof. Burger could not accept Ten Siethoff's standpoint in general, but saw cases with the most pronounced symptoms of Menière's disease favorably influenced through nasal treatment. He describes a case (reported separately).

Dr. van Anrooy mentioned a case of dizziness with latent



inflammation of the maxillary sinus, however without aural disturbances.

Prof. Zwaardemaker pointed out that different sorts of dizziness have been reported, some in connection with middle ear affections, and mostly insufficiently explained. The vertigo nasalis does not belong to the picture of Menière's disease. Here the three chief symptoms must predominate. Ten Sie-thoff's opinion of a reflex, originating from the nose, is untenable. The supposed reflex arc is not known.

Dr. Hartog stated that the cases mentioned by him in the previous meeting had been examined acoustically. He mentioned also a case of serious Menière's disease with suppuration of the sphenoid sinus. The dizziness appeared when the secretions had accumulated high up in the nose. He considered the connection unquestionable.

Dr. Polak thought that in some cases the connection is apparent, and the recovery from the dizziness accidental.

Dr. Boon mentioned a typical case, with two to three attacks daily. Air insufflations and massage after Breitung had little result. The pressure probe of Lucaë helped directly, and three months' treatment with it made the recovery permanent.

*Blaauw.*

#### **Aural Pyemia.**

H. BURGER (*Tydschr. v. Gen.*, February 1, 1908), after describing the general signs of pyemia which accompany sinus thrombosis, gives the details of the first four cases of otogenic inflammation of the transverse sinus, which came under observation during the first year of the University Clinic for Ear, Nose and Throat Diseases in Amsterdam. The clinical picture depends upon the closure of the vessel and the suppuration of the thrombus. Headache, vomiting, changes of the pulse, etc., can be present. Often compression symptoms are absent. Generally the blood infection predominates, rarely under the picture of toxemia with high fever, unconsciousness, paralysis of the heart, etc.; much more frequent is the pyemia with high rises and quick lowering of the temperature, severe chills, swelling of the spleen, metastatic suppurations in the lungs and everywhere in the region of the large circulation. However, thrombosis of the sinus can be present without pyemic fever. Burger operated some years ago on a young man with an acute mastoiditis, with slight elevation of

temperature. He found a perisinus abscess with abundant granulations on the dura mater. At the first dressing of the wound the dura mater looked much clearer, and an opening was found in the wall of the sinus, which had been covered with granulations during the operation. The obstructing thrombus could be seen towards both sides in the open sinus. The case recovered without disturbance. Especially in little children the typical fever type is found absent.

CASE 1.—A seriously sick man, 28 years old, entered the hospital on December 10, 1906. He was apathetic, answered slowly but correctly. The right facialis was paretic in all its branches. He had been sick for two to three weeks; headache, fever, soon confined to his bed. For four days he had had chills, with high temperature. The day before, the temperature in the morning was  $39.5^{\circ}$ , in the evening  $40.3^{\circ}$ , yesterday  $38.5^{\circ}$  and  $40^{\circ}$ . Since the commencement of the disease the right ear, which had formerly secreted now and then, had begun to run again. No nausea, vomiting or dizziness. The right external ear is filled with fetid pus and granulations, which make the drum invisible. Pressure on the mastoid process is painful. No sign of brain pressure or cerebral inflammation. Diagnosis: Secondary inflammation of the transverse sinus. The same day, operation. The mastoid process consisted of one cavity filled with partly purulent and cheesy, partly cholesteatomatous masses. The posterior wall was sclerotic; towards the front the posterior wall of the external canal had nearly disappeared. The auricular bones were not found. The bony wall of the labyrinth, as far as visible, was smooth and normal. In the point of the processus, a carious fistula, which, after enlargement with the chisel, led into the posterior cranial cavity. Pus and a large quantity of black, reddish, watery, fetid fluid escaped. The fistula led towards a gangrenous spot in the wall of the transverse sinus. This was exposed until its wall looked normal. Patient stood the two hours' operation well. During the night he had two severe chills. The temperature directly before the operation was  $38^{\circ}$ , went up during the night to  $39^{\circ}$ , in the morning  $40.3^{\circ}$ , sank during the day to  $37.2^{\circ}$ , and rose again during the night to  $40^{\circ}$ . This led to ligation of the jugularis int., which looked normal, with fluid blood. The bandage of the first wound was soaked with blood, and what

had remained in the surrounding of the sinus had a most disagreeable stench. On the fifth day the disease took an unfavorable turn. The patient vomited in the afternoon, the temperature rose (in the evening,  $39.8^{\circ}$ ); a slight papillitis was found in the right eye, in the left the disk was slightly hazy upward and downward. The condition was also unfavorable on the sixth day; he responded more slowly. Patient dozed usually with the left eye closed. No headache or any sign of meningitis. On dressing, yellow, odorless pus was found, with the exception of the peripheral part of the sinus, which still produced black fetid pus. It contained a black, soft thrombotic mass. A third operation removed the bone over the horizontal part of the sinus in the direction of the confluens sinuum; the sinus was cut open over a length of 5 to 6 cm., the thrombotic clot removed, when bleeding appeared, which needed tamponing. The outer sinus wall looked healthy and pulsated. The operation was well borne. During the day the patient complained of pain low down in the right side, especially with deep respiration. No change on percussion; with auscultation pleuritic fremitus. The skin and scleræ showed a yellowish tinge. During the evening again a chill, with temperature  $39.4^{\circ}$ , frequent (132), small, hardly palpable pulse and disturbance of consciousness. Injection of camphor oil. From now on the pyemic fever was most pronounced. During the 13th and 18th day the daily differences were of 3 and 4 degrees, now and then chills, sometimes vomiting, but no headache or any sign of meningitis. His subjective feeling remained good until the end. The icterus increased without enlargement of the liver. On the 17th day pleuritic fluid was aspirated and resection of a rib performed. A large quantity of very fetid, thin yellowish fluid was removed. The head wound looked continually better. No more secretion from the middle ear, nor from the fistula or the central part of the sinus, which was already partly filled with healthy granulations. Only the peripheral part secretes slightly, but the stench has disappeared. Death on the 21st day. The remaining part of the right transverse sinus contains a noninfected thrombus as far as the confluens sinuum, progressing a little in the longitudinal superior sinus and in the left transverse sinus. Cerebral edema, but no abscess, no inflammation. Right, putrid pleuritis, mediastinitis, pericarditis.



Spleen spotted; nutmeg-liver, but no liver abscess. All tissues icteric.

CASE 2.—On May 6 a 24-year-old bookbinder was brought to the hospital complaining that fourteen days before, he had come home sick, tired, feverish and drowsy. He remained in bed with continual fever. For eight weeks he had suffered with right-sided earache and dizziness. Eight days ago he had a dizzy spell, during which he seemed to turn quickly around. This morning he had a chill of half an hour, a week ago one which lasted half the night. The right ear runs for about four years, although it is deaf since childhood. Three days ago a swelling appeared behind the ear, painful to touch. He looked very sick; temperature, 40.4°. Right mastoid region reddish, painful, not swollen. A few centimeters backward a painful fluctuating swelling. In the meatus fetid pus and granulations, which prevented the drum from being visible. Papillitis in the right eye; left fundus and drum normal. No other changes. The hearing of the right ear is greatly decreased; hearing for bone conduction with tuning fork has increased in this ear. Diagnosis: Chronic otitis media with inflammation of the transverse sinus. The same evening, operation. Fetid pus escapes directly after removal of the external bone plate, and at the point of the processus the black discolored transverse sinus appeared very near the surface and forward, about  $\frac{1}{2}$  cm. only behind the bony auricular canal. The sinus was laid bare posteriorly, showing a normal color about 5 cm. backward. The central part towards the jugular bulb was entirely necrotic. The antrum was filled with granulations and pus. The v. jugul. int. was tied near the larynx; it was normal with fluid blood. The operation lasted two and three-quarters hours and needed 9 cc. chloform. During the following day, twice rise of temperature to 39.1° and 41°, with remissions of 36.9° and 38°. Three days after the operation the right papillitis is unchanged and in the left eye incipient papillitis; papillæ not more sharply limited and veins enlarged. Patient feels excellent. Temperature, however, rises to 39.2°. Next day the neck and the lower part of the right cheek was swollen and painful. A large cavity with thin, yellow, fetid pus was opened. Seven days after the operation the disk became more normal; veins,



only, enlarged and tortuous. The following day, with renewed rise of temperature, expectoration of thick, yellow, nearly pure purulent sputum. Next day the horizontal part of the sinus posteriorly was opened; over 2 cm. long it was empty. The temperature, however, did not drop to normal; respiration was quickened (40 to 48 per minute). Subjectively feeling good. Ten days later 110 cc. slightly opaque serous fluid is withdrawn from the left pleural cavity, free from organisms. The diagnosis of left lung abscess was made. Three days after the puncture an edema of the entire thoracic wall, forward and backward, appears. The heart is pushed to the right. Puncture below the shoulder blade produces thin, yellow, fetid pus, about 1000 cc. This fluid contains a pure culture of cocci. A large lung abscess had perforated into the pleural cavity with formation of a pyopneumothorax. Patient needed stimulation. Next day again tapping, and on the following day thoracotomy. During the following days a gaseous subcutaneous phlegmon developed from the thorax wound and spread over the entire back. In three different parts of the lumbar region vertical incisions were necessary for the escape of yellow greenish, fetid pus, which was mixed with gas. These incisions led into a large abscess cavity, which contained necrotic tissues and undermined the skin of the entire back. A few days after the last operation fluid injected into the lumbar wounds flowed out of the wounds in the thorax. Although he looks very bad, he keeps feeling well, sleep and appetite good. He is very emaciated and weak. Constant high fever. The emaciation progressing; incontinentia alvi sets in. An edematous swelling of the sacrum heals under wet dressings. Later a para-articular abscess of the left shoulder developed; after incision, much thick pus. Two days later an empyema of the right pleural cavity was found, with much yellow reddish pus. Next day swelling of left elbow and forearm with much edema, which disappeared under wet dressing. At the same time an abscess in the perineum developed, which discharged much pus after incision. The general condition looks bad; he is wax-pale, emaciated ad maximum. The blood contains 50% hemoglobin; temperature up to 39.6°; pulse 160 to 180; respiration 44 to 52. From July 11th the temperature began to drop; since August temperature nearly constantly normal. At the same time the

nutrition improves, and in November Burger could present the patient to the Amsterdam Medical Society as recovered. As the radical operation had not been done, for obvious reasons, the ear needed much treatment, but after removal of a few sequestra the purulent secretion stopped.

CASE 3.—Girl, 22 years old, was brought in very sick and deaf. The left ear runs since some years. Nine days ago patient became suddenly sick with vomiting and pain in the left ear; fever; later headache, sleeplessness, chills; during the last few days complains of headache, pain in the neck, and diminished vision. On admission she was very sick; temperature around 40°. Head inclined towards the right; motion of the head, especially towards the left, painful. Now and then convergent squint. In both eyes papillitis. Kernig's symptom on both sides. Slight albuminuria. Pulse in accordance with the temperature, although now and then irregular and unequal. The right drum is perforated; some odorless mucous secretion. A scar behind the ear, but no swelling or pain on pressing. Much pain on pressure over the left mastoid process, directly behind the antrum (Griesinger's symptom). The upper posterior wall of the canal obstructs by its swelling the view of the drum; odorless mucus. Diagnosis: Inflammation of the left transverse sinus, consecutive to chronic inflammation of the left ear, with doubtful meningitis. The same day, operation. The proc. mastoid. was chiseled open at the typical place. Directly after removal of the external bony wall a cavity was found from which comes a cadaveric odor. This cavity is not a mastoid cell, but the posterior brain cavity, which extends very far forward into the temporal bone, touching directly the ear canal. At that place the transverse sinus was thrombosed. The very small mastoid was filled with granulations, which also filled the antrum. The radical operation was performed. No vestige of drum or ossicles. Removal of carious bone of the roof of the middle ear opened the middle brain cavity, from which pus came under high pressure. This extradural abscess was widely opened. The dura had a purulent membrane near the tegmen. The sinus then was laid bare until it looked normal; the discolored part was limited to the sigmoid sulcus. During this act pus appeared internal to the sigmoid sulcus, deep in the posterior brain cavity, between the temporal bone and

dura. This was drained with two fine tubes. The stinking contents of the diseased part of the sinus were removed, until hemorrhage appeared. Bandage. Duration, over two hours. The temperature after the operation remained pyemic. Some meningitic symptoms were present: Restlessness, psychic and motoric; screaming. Pulse relative to the temperature, slow (at 40.5°, 90; at 41.5°, 100). Intermittent squint with double vision; Kernig's symptom constant. She complains of constant headache and pain, especially in the neck and back. Consciousness remains intact. On the third day, three chills; on the fifth, pleuritis of the left side. The temperature fell on the morning of the sixth day from 40.2° to 36.8°; pulse 74. With lumbar puncture under 18 cm. pressure a couple of cc. clear fluid. The v. jugul. int. was ligated, found normal with fluid blood. Exitus the same evening without pain or spasms. The cerebrospinal fluid was that of meningitis; it contained many leucocytes, nearly all polynuclear. The wound smelled bad at the change of dressings on the fourth day. From the posterior cranial cavity internal to the sinus some pus still escaped. The dura of the middle cavity granulated, with the exception of a small necrotic spot. At the autopsy leptomeningitis of the entire cranial base was found, most pronounced at the base of the left cerebellar hemisphere. Here dura and cerebral substance were purulent infected. The pus, which had escaped during the operation from out the posterior cavity, proved to have come down from the purulent subarachnoidal cavity through a defect in the dura.

CASE 4.—Five-year-old child; running ear for fourteen days; received with high temperature; very sick. Painful swelling behind the ear. In right meatus hemorrhagic, mucopurulent, fetid fluid; drum red. Left drum also dark red, not bulging. Diagnosis: Acute otitis media in both ears; inflammation of the right mastoid with imminent perforation outward. Incision liberated stinking pus. Next day, opening of the mastoid; no fistula or discoloration of the external bone. The bone is very sanguineous, infiltrated with pus; antrum filled with pus. Pus appears backward from out the posterior cranial cavity, under pressure, and pulsating. A perisinus abscess was opened and a collapsed sinus found, discolored for a short distance, which could only with dif-



ficulty be distinguished from the surrounding granulating dura. The left drum was incised. The child remained very sick. Next day edema of the right, later also of the left, upper lid; progressing inflammation of the cavernous sinus. No sign of meningitis except occasional vomiting. The edema diminished, but a left exophthalmus developed. The fifth day after the operation the child died quietly. Autopsy not allowed. No bacteriologic examination. The sanguinolent character and the excessive stench of the discharge are striking, since a known cause of the otitis was absent. The temperature curve was not typically pyemic, as is often the case in young children. The high and quick temperature variation, as well as the chills, are absent; the fever is more a continuous one. If Griesinger's symptom is also absent, the diagnosis of sinus inflammation cannot be made, especially as in children an acute otitis media and mastoiditis can be combined with high fever and signs of meningeal irritation.

Burger has been taught by experience that the middle and posterior cranial cavity must be opened in every case of intracranial inflammation consecutive to otitis. He also considers repeated changing of the dressings desirable, even to three and four times daily. Some days after operation the gauze in the central part of the sinus did not sufficiently suck up the stinking fluid. The hemorrhage from the sinus, which is sometimes renewed, is not sufficient contraindication. Ligation of the jugular vein does not with certainty prevent infection of the bloodstream. A number of cases recover without it, but Burger thinks he saved his second patient through it. It should be done when the sinus inflammation goes further centrally than the sigmoid sulcus, and if it is not done during the first operation it should be done as quickly as possible if the signs of pyemia remain.

Blaauw.

## II.—NOSE.

### Atypical Operations on the Accessory Nasal Cavities.

PREYSING (*Zeitschrift für Laryngologie, Rhinologie und ihre Grenzgebiete*, Bd. III, p. 17) reports six cases of very extensive malignant growths, which had their origin principally in the region of the ethmoid. He makes a horizontal incision parallel with the eyebrows and a perpendicular in-



cision down along the bridge of the nose. The anterior walls of the frontal sinuses and the entire bony septum and one side of the nose is removed as far back as the sphenoid if necessary. Remarkable results were obtained, and, judging by the photographs and taking into consideration the severity of the disease, the cosmetic results are better than one would expect.

*Horn.*

#### **Treatment of Epistaxis.**

BEVERLEY ROBINSON (*New York Medical Journal*, July 31, 1909) advises for obstinate epistaxis, plugging the nose with aseptic absorbent cotton twisted to the size of the little finger and introduced with a probe under a good light as far back as the posterior pharynx. In people past middle life it is usually dependent upon arteriosclerosis. A saturated solution of copper sulphate applied to the bleeding point on a cotton-covered probe is the best application for controlling it.

*Harris.*

#### **A Case of Nasal Tuberculosis Terminating in Tuberculous Meningitis.**

A. J. HUEY (*New York Medical Journal*, August 7, 1909). The patient was a woman 39 years old, with no history of tuberculosis in the family. When first seen the left nasal chamber was completely filled with a friable vascular tissue resembling an adenocarcinoma. There has been increasing difficulty in nasal breathing for the last four years, with severe headache at times. Microscopic examination reported the growth to be tuberculous, with marked edema. Three portions of the growth were removed, re-establishing nasal respiration. The septum and turbinates had been entirely destroyed. Treatment by means of the Röntgen ray was begun. Three weeks after the removal of the first portion of the growth the patient complained of severe headache and dizziness, ringing in the ears and deafness. High fever developed with delirium, followed by coma and death in four days. A diagnosis of tuberculous meningitis was made. No post-mortem was made. The possibility that the meningitis was pyogenic and not tuberculous is admitted. The author bases the diagnosis, first, on the slow onset, and second, on the fact that the meningitis was confined to the base of the brain and did not become general. He has been able to find but one parallel case in literature.

*Harris.*

**Sarcoma of the Nose, With Report of a Case.**

J. PRICE-BROWN (*Journal of Laryngology*, October, 1909) makes a further contribution to the treatment of sarcoma of the nose by means of the galvanocautery. In addition to the three cases already reported, he reports four others treated by the same method. Out of the first six cases there was a recovery of 83%, or, regarding the last three cases too soon to report upon, a recovery of 75%. His grounds for the advocating of this method of treatment are:

1. In sarcoma of the nose the usual site of origin is in the soft tissues and not in the bony framework which supports them.

2. That the origin is in the form of a pedicle, which rapidly becomes sessile.

3. That as the sarcomatous mass enlarges and presses upon the surrounding mucosa, abrasions take place, which are quickly transformed into adhesions; and these adhesions in time will become almost coextensive with the disease itself.

4. That these adhesions never attain the vitality and virile power possessed by the pedicle. Hence, when once thoroughly destroyed, they do not form again.

5. Recrudescence, however, frequently takes place in the region of the pedicle; and in view of this contingency this region should be kept under regular observation and control.

6. When the nasal passage is filled with the sarcomatous growth any attempt to discover the site of adhesions will at once produce hemorrhage. Hence, intranasal removal by the knife should not be attempted; but as gradual and systematic dissection out by the cautery knife, except in extreme cases, is always available, it should not only be encouraged, but should be insisted upon.

Harris.

**The Anatomic and Clinical Relations of the Sphenopalatine (Meckel's) Ganglion to the Nose and Its Accessory Sinuses.**

GREENFIELD SLUDER (*New York Medical Journal*, August 14, 1909) has made a careful study of the anatomic relations of Meckel's ganglion to the nose and accessory sinuses and points out in a convincing way the liability of its involvement in connection with disease of the accessory sinuses. Contrary to the usual impression, it lies in the pterygopalatine fossa, very close to the external bony wall of the nose, frequently only one

or two millimeters from the nasal mucous membrane. The sphenoidal sinus may form the entire upper boundary of this fossa, or the wall of the nose may curve so sharply outward as to form part of the anterior boundary. The sphenopalatine foramen is situated just posterior and immediately above the posterior tip of the middle turbinate. The ganglion usually lies close to the plane of this foramen, although not always. The author, from its anatomic relation to the pterygopalatine fossa, regards it as resembling an accessory sinus. In his experience characteristic disturbances have followed post-ethmoidal and sphenoidal suppurative inflammation, which cannot be explained otherwise than that Meckel's ganglion has become involved by extension. In 47 cases under his observation the typical picture is one of pain which begins at the root of the nose and extends downward to the maxilla and backward on the mastoid about 5 cm. posteriorly to its tip, thence extending backward to take in the entire occiput and downward into the neck. He gives the report of several cases where relief or cure have been obtained by the application of cocain over the sphenopalatine foramen or the injection of alcohol directly into the ganglion.

Harris.

#### Acute Forms of Sinusitis.

A. RIVIERE (*Revue Hebdomadaire*, July 3, 1909). In the author's opinion, acute affections of the accessory sinuses have been overlooked, especially where acute exacerbation of chronic affection takes place. The symptoms are liable to be very severe for the time. He gives the history of two cases in his own practice. The first one was a man of 35, who had suffered from chronic sinusitis for some time, but refused operation. He was seized while motoring, with a violent pain in the head, chills and fever. The usual nasal discharge was suspended temporarily. The pain was so severe that the patient was delirious when he arrived at his destination. Anterior rhinoscopy showed pus along the left middle turbinate and edema and congestion of the nasal mucosa on both sides, especially on the left. There was also edema of the uvula and soft palate. The left frontal sinus was sensitive, but translucent. This condition lasted for 48 hours, and then, under proper treatment, gradually improved.

The liability of such a condition being confused in the mind



of the general practitioner with a more serious cerebral involvement is pointed out. Attention is then directed to the importance of sinus involvement in cases of grippe. In the involvement of the sinuses is to be explained the persistence of certain symptoms, prolonged convalescence, digestive troubles, headache, etc., all the result of a low order of infection of the sinuses. The onset of the involvement of the sinuses in these cases is characteristic. At first there is only a sense of dryness, with a feeling of obstruction in the nose, associated with violent headache. This may be variously situated in the occiput, frontal region or at the root of the nose. It is characterized by being increased on walking or sitting upright, and is better in the reclining position. At the second or third day there is a slight improvement coincident with the reappearance of the secretion. Two symptoms will be noted in addition to those of severe coryza; first, subjectively, a sensation of a piece of skin in the rhinopharynx, which the patient tries hard to get rid of, and second, objectively, the presence of considerable edema of the uvula and soft palate with ecchymotic spots, but without tonsil participation. Anterior rhinoscopy does not show any pus, but only edema and congestion, although mucopus is found by posterior rhinoscopy. The mucopus is the occasion at time of attacks of cough which are quite annoying. With the advent of the discharge, the intensity of the pain is diminished. Spontaneous healing takes place at the end of the fifth to sixth week.

For local treatment the author employs, apart from adrenalin and menthol, small tampons in the nose of glycerinated cotton and copious hot irrigations in the pharynx. *Harris.*

**Intracranial Evolution of Nasopharyngeal Polyps. With Report of a Case.**

GAUDIER (*Revue Hebdomadaire*, October 23, 1909). The patient was a child of 11 years, who for two years had nasal obstruction. He gave the characteristic adenoid facies. There had been nasal hemorrhage at times. An attempt had been made to remove the growth by means of forceps, but the severity of the bleeding prevented. When seen by Gaudier the tumor was pushing the soft palate down. It was hard and could be easily outlined with the finger. The mass bled easily, but less so than sarcomata in that position are wont to do.



Without a speculum one could recognize in the right nares a bleeding mass. The right maxillary sinus was dark by transillumination. The canine fossa on that side was pushed out under the skin, showing that the sinus was enlarged by the prolongation of the tumor. The growth was removed with Escat's forceps under chloroform. After the resection of the right superior maxilla the tumor was found attached to the base of the skull, but by skillful manipulation was enucleated from the sphenoidal sinus like a cork out of a bottle. An uneventful recovery took place.

For two years the child remained well. At the end of that time he returned because of excessive bleeding from the nose and mouth without any apparent cause. The child was very anemic, but showed no return of the growth. Further examination was deferred until the next day. During the night the patient was taken with a severe hemorrhage and died. The autopsy showed, after removal of the calvarium and brain, a large mass resting on the sella turcica, which had raised the dura mater. This tumor, however, on the left side had penetrated the thickness of the sphenoid on its lateral wall and appeared to have ulcerated the cavernous sinus. Further examination showed actual erosion in the body of the sphenoid by the growth which had proceeded from the right sphenoidal sinus and raised the dura mater without injuring the carotid or the external oculomotor nerve.

The author discusses at length the various phases in regard to the extension of nasopharyngeal fibromata into the cranial cavity. Although there are only 29 cases reported where such extensions have taken place, in his judgment they are vastly more common than that. It is generally held that the extension takes place through the cribriform plate of the ethmoid. Of the 29 cases in only 6 was a diagnosis made before autopsy. De Gandt, who has made a careful study of these cases, places much importance on the use of the ophthalmoscope in diagnosing. It must be borne in mind, however, that the penetration takes place in different localities, and sometimes the optic nerve would not be involved. The author agrees with Verneuil that it is absolutely impossible to diagnose these prolongations; one can only suspect them.

The author concludes that we are justified in suspecting intracranial prolongation without any symptoms, and that the only proper course to be pursued is a good opening of the

operative field with ablation of the growth and exploration of the point of implantation. Accordingly the resection of the superior maxilla, which gives such a field, especially if one employs the electric headlight (permitting of a thorough exploration), should always be practiced in cases of this kind.

Harris.

#### **Regional Anesthesia in the Radical Cure of Maxillary Sinusitis.**

MUNCH (*Revue Hebdomadaire*, November 20, 1909). The author gives a resume of the various methods employed for local anesthesia in operation upon the antrum of Highmore, and points out that all of them as far as producing complete anesthesia are faulty. He accordingly advocates and practices direct anesthesia of the superior maxillary nerve itself. This is to be done at the point where it emerges from the base of the skull in the posterior floor of the pterygomaxillary fossa. The solution is introduced at the point of election, the anterior border of the zygomatic arch indicated upon a figure which does not accompany the article. The nerve is encountered at the depth of 5 cm. He employs a 1% solution of cocain containing a small quantity of adrenalin chloride. Only a few drops of the solution should be used. From ten to twenty minutes are required to obtain anesthesia. At that time the lip, the gum, cheek, lower eyelid, middle portion of the temporal region, diple and uvula are rendered insensitive. The anesthesia persists for an hour and a half, after which the nerve gradually regains its functions. While it is possible to strike the coronoid process of the inferior maxilla and pterygoid process of the sphenoid, no harm will result, and inclining the needle a little forward will correct the direction. It is also possible to enter the orbit by directing the needle too much in advance. The blood vessels are situated at such a depth that there is no danger of wounding them. In favor of this method of anesthesia the author urges the absence of pain, danger of swallowing blood and pus, and the entire freedom from shock.

Harris.

#### **Functional Nasal Impermeability and Its Correction by Means of Re-education.**

Foy, Paris (*Revue Hebdomadaire*, November 27, 1909). Nasal respiration is physiologic respiration. In many cases, however, buccal respiration with all its attendant dangers is

substituted, sometimes as the result of a mechanical obstruction, capable of being removed, situated in the nasopharyngeal tract; sometimes, however, without any such obstruction the respiratory function is entirely lost. In the first case we are dealing with mechanical impermeability, and in the second with functional impermeability. Functional impermeability is the inability to breathe through the nasopharyngeal passages air in sufficient quantities to sustain life. The cause of this is to be found in some obstruction, which existed at one time and which has disappeared, either as the result of operation or spontaneously by atrophy. These affections present variation in intensity and in form. Sometimes the difficulty in respiration is only at night; in the daytime no mouth breathing can be detected. In other cases mouth breathing persists day and night. Two types are to be distinguished: Insufficiency and impotency. Nasal insufficiency is the intermediary form between pure mechanical impermeability, the result of nasal obstruction, and functional impermeability, the result of nasal impotency. It is in reality a mixed impermeability. In the first instance it is functional, because the passage of air is not impossible, as in obstruction, there being not only an anatomic atrophy of the mucous membrane, but also functional derangement, the result of a faulty bulbar co-ordination of the respiratory movements and hypoesthesia of the nasopharyngeal mucosa, and in the second place, mechanical, because the respiratory mechanism is entirely insufficient. The nasal fossa, pharynx and thorax are in a condition of atresia, and, so to speak, atrophy in their muscles as well as in their bony framework. The explanation is easy. Insufficiency is always the result of pronounced obstruction of the nasopharynx or of the nasal fossa in infancy, or at an age when the skull is not fully developed, especially the facial bones. The obstruction will serve thus to arrest the development of the organ adapted to this function, that is to say, the nose and nasopharynx. The thorax will undergo the same atrophy, inasmuch as buccal respiration demands less effort on the part of the thorax than nasal respiration.

Occurring in childhood, the obstruction is usually in the nasopharynx. The face becomes deformed, is flattened laterally, shows the regular adenoid facies, the teeth more or less badly placed, the upper lip short, the nasal fossæ and naso-



pharynx narrow and the arch of the palate flattened and paretic. The nasal alæ are atrophic and paretic, small and approach the septum during inspiration. The thorax is atrophied and deformed. The nasal respiratory insufficiency is conspicuous. The nasal mucous membrane is often pale and atonic. The spirometer shows the respiratory capacity often far below the average. Fortunately all sufferers from adenoids do not suffer from nasal insufficiency, and a large number after operation regain in a few days nasal respiration. Those who are afflicted are generally former sufferers from adenoids who were not operated upon, and where in time spontaneous absorption of the adenoid has taken place.

The second form of functional nasal impermeability is nasal impotency. Here there is no anatomic derangement, no atresia, no atrophy of the respiratory organs, only a slight paresis of the alæ and of the roof the palate, no adenoid deformity, the nasal fossæ the proper size, often too large; the thorax is not deformed, and general condition good. The symptoms, however, are the same as those of pure obstruction or insufficiency, disturbed sleep, buccal respiration day and night, etc. The cause is to be found in a former nasal obstruction occurring not, however, as in nasal insufficiency, in infancy, but in adolescence or adult life at a time when the skull has become entirely developed. The obstruction is not an adenoid, but a hypertrophied rhinitis, polyps, etc.

In persons suffering from nasal impotency respiratory mechanism is functionally deranged in three different localities, in the nasal fossæ, in the bulb and in the psychic centers.

Physiologic respiration is an act at times voluntary, conscious, subconscious and reflex. Where a mechanical obstruction to breathing exists the subconscious act becomes conscious, and we voluntarily change the method and breathe through the mouth at first consciously, but later on, unconsciously, until physiologic nasal respiration is totally forgotten. When the nasal fossæ are free it is necessary, in order to resume the former physiologic breathing, to make an effort of the will. If the will is not strong enough or the bad habit too long acquired, the nasal impotency will continue. In addition, there exists the lost sensation in the nasopharyngeal mucous membrane which enables us to appreciate the subconscious mechanical friction of the air passing through the nose and without



which even if the nasal fossæ are free nasal respiration is impossible. Finally as a result of the perversion of the conscious, subconscious, peripheral and central respiratory function, the bulbar centers themselves suffer and give rise to incoordination of the respiratory reflex movements so that the sufferers come to have true ataxia of the nose.

*Treatment.*—The usual methods of respiratory re-education will fail except in the mildest cases. The exercises, moreover, are fatiguing, physically and mentally. While these exercises should not be abandoned, the author regards it important that they be adequately supplemented. For this purpose he has devised an apparatus which he has employed with increasing success. This consists of two tanks of compressed air, provided with air gauges and connected by means of rubber tubing with a glass reservoir provided with a U-shaped container. By means of this container the air is allowed to escape, under proper regulation, by a rubber tubing, into two olive-shaped tubes made of metal, for insertion into the nostrils. These have two holes, the upper for the respiration of the air and the lower for its exit. The method of use consists, after proper adjustment of the olive tubes, held in place by a head piece, of the inspiration of the air (pure or mixed with oxygen) into the lungs and its escape through the same channel, the mouth being closed. Inspiration is gentle, but deep. There is a short interval of repose, and then a repeated expiration with a longer repose. The exercises are continued for ten to fifteen minutes.

In this way Foy has secured the following results:

1. The dilatation of the nasal alæ.
2. The stimulation of the sensibility of the nasal mucosa.
3. When necessary, restoring the roof of the palate to its proper suppleness, elasticity and mobility.
4. The development of the expiratory and inspiratory muscles.

The reports of a number of cases are given where this method has been employed with benefit. *Harris.*

#### A Newly Discovered Cartilage Formation in the Nasal Septum of Man.

HABERFELD (*Monats. für Ohrenheilkunde und Laryngo-Rhinologie*, XLIII, Jahrg., 1909, 4 Heft, p. 241) says that in

50 per cent of cases of adults which he has examined there is on the mucous membrane of the posterior edge of the nasal septum a piece of hyaline cartilage, somewhat oval in shape, with its long axis parallel to the posterior edge of the vomer. In children and new-born infants this cartilage formation is very rarely found, and not at all in the fetus. Haberfeld believes in the rudimentary nature of this cartilage, because of its absolutely typical position, the frequency of its occurrence in adults, and that the cartilage never goes on to enchondral ossification. He is, however, unable to give to it any phylogenetic importance, as neither in man nor in animal is there any known organ occupying this position. He calls attention to the possibility of enchondral tumors developing out of this cartilaginous center. *Wood.*

#### A Divergent Olfactory System.

J. VAN DER HOEVEN LEONHARD observed that he was unable to smell eugenol under circumstances when normal persons perceived clearly the smell of cloves. At some other time he perceived, e. g., the smell of scatol in such a dilution when other observers did not get a positive impression. He then examined himself for the nine groups of odors and shows a graphic reproduction of the deviation, where the logarithms of the found values are used. With his abnormal osmasia abnormal trichomasia is combined. *Blaauw.*

#### Affinities of Smells.

PROF. ZWAARDEMAKER. Nine standard smells (amyl. acetate, nitrobenzol, terpin oil, muscon, ethylbisulfide, guaiacol, valerian acid, pyridine and scatol) were made suitable for olfactometric use by solution in paraffin. In a suitable olfactometer the minimum perceptible and its probable fault are determined, and this value used as unit of olfactive excitation. The nine standard smells, combined two to two in 36 ways, give as many mixtures. Emulation, or indistinctness of smell, a few times even absence of smell, can be produced with these when the relation is well chosen. A large table shows these relative numbers. Deeper insight can be acquired in two ways: (1) By combining the idea of a vector with the smell irritation and deducing the direction of these vectors from the relative numbers. (2) By considering the relative numbers

typical arithmetically as tangent values and combining together the corresponding angular value. The first method gives him, who understands well the represented arrangement of the smell-vectors, a conviction of the present affinity based on evidence, while the second method gives an easy survey as a purely graphic remedy without the necessity of any supposition. Both methods lead to the same result. The possibility of a compensation between two standard smells demonstrates that both excitations can influence each other in such a way that both sensations, which otherwise arise, can weaken each other simultaneously, even to annihilation. The relative numbers are of value for a certain latitude, which Zwaardemaker calls the zone of cardinal proportions. The presence of this zone induces him to accept a multiplum of olfacties of one entity of compensating excitations. In the cases where the relative numbers are identical we have to suppose an identical way of influencing the consciousness. From a definite point of view, connected with the quality of smell, such excitations are therefore conformable, although they may be different in other points. When this identity, looked at from a definite standpoint, repeats itself different times under entirely different circumstances, it causes the acceptance of a deeper affinity of these qualities. So amyl acetate, nitrobenzol, terpin oil, guaiacol on one side and valerian acid and scatol on the other side seem more or less related. The physical significance of the established relationship is the demonstrated possibility for treating certain smell mixtures as well with the one as with the other fixant. In general, the doctrine of fixating substances, of great importance for the perfume industry, can be established on a methodical base by the developed system. Zwaardemaker then demonstrated a mixture-olfactometer.

*Blaauw.*

#### Local Anesthesia in Nose Operations.

W. SCHILPEROORT. Of the three ways: (1) Diffusion from the mucous surface; (2) direct infiltration after Schleich; (3) indirect infiltration from one focus, the last one is the preferable one for the nose. Injection in an easily accessible place of a  $\frac{1}{2}$  to 1% solution of cocain with two drops of adrenalin to one cc. is the surest, safest and simp'lest way. The needle must be moved in a forward and backward direc-



tion and in different directions to diffuse the fluid over a large area. Fractional sterilization gives a germ-free solution; or the necessary cocain can be dissolved in strong alcohol, and after evaporation the residue redissolved in sterilized salt solution (Mikulicz). The contractive action of adrenalin is not followed by vasodilatation. Still, it is preferable to tampon after the operation, because after the adrenalin action hemorrhage may appear, and one does not know in advance how serious this may be. The only by-effect observed by Schilperoort is palpitation of the heart directly after or during the injection, only of short duration. He used the method in 20 to 30 operations of fenestra-resections after Krieg or Killian. The needle was introduced as deep as the deflection of the septum allowed and drawn out during the injection. It was used also in some ten cases of removal of hypertrophies of the lower concha, with and without the bony implantation. After touching the anterior part with 10% cocain the needle was pushed deep in the concha toward the bone, pushed up along the bony border and drawn out slowly during injection; 1 cc. of a 1% solution of cocain was necessary. After 10 minutes as much can be removed as is necessary. It was used also in some 10 to 20 extractions of a molar or root, and openings of the antrum through the root canal; injection in the gum of 1 cc. of 1% cocain, half at the side of the tongue, the other half at the buccal side. It was also used in two cases of radical operation of the antrum after Luc.

Struycken warned against generalization in either direction. During operation it is often necessary to resort to general narcosis, e. g., when, after opening of the antrum, septa are found, or when the suppuration appears to originate in the posterior ethmoid cells. Some, who stood the operation very well, suffered for months afterwards with general nervous symptoms. He uses for local anesthesia alypin with adrenalin.

Wilkens did the Luc operation during the last year in Semarang (Dutch East Indies) on 14 cases of antrum disease, under local anesthesia, even outside of the hospital, and likes it very well.

Burger mentioned that in his clinic five such cases have been operated, and in his private practice twice in a 50-year-old lady. She stood the operation very well, but her nervous system needed a couple of months before it was normal again. He



advocates the method, with the restriction that some persons need general narcosis.

Moll thought that even with general narcosis cocaine can be injected and thus the operation be bloodless. The reclining position is preferable on account of the danger of poisoning.

Schilperoort said that the "nervousness" is difficult to determine beforehand. The success when one operates is often beyond expectation.

*Blaauw.*

### III.—PHARYNX.

#### **An Epidemic of Tonsillitis Combined With Sepsis.**

LIEBL (*Med. Klinik*, No. 2, 1910) reports 35 cases of an endemic character, with all grades from the lightest symptoms to fatal cases of poli-encephalitis. In one case the infection was so severe that symptoms of acute infection followed in six hours, in another death followed in 30 hours. No bacteriologic examination was made.

*Horn.*

#### **The Ideal Tonsillectomy.**

J. M. PRATT (*New York Medical Journal*, April 2, 1910). Pratt regards the ideal method of removing the tonsils to be the freeing of the supratonsillar lobe by means of a knife with a curved, wavy blade. The tonsil is then loosened by the finger, dissected in its upper portion and then removed complete by means of the snare, which is left in position for five minutes in order to avoid bleeding. He condemns rapid method removal, because of the liability of hemorrhage.

*Harris.*

#### **Indiscriminate Enucleation of the Tonsil.**

PERCY FRIDENBERG (*New York Medical Journal*, January 10, 1910). The author raises his voice in remonstrance against the indiscriminate removal of the tonsil in toto. If it is to be done, he favors finger enucleation, but he questions whether in all or in most cases the entire removal is safe, necessary or useful. He argues that the prime consideration is removal of obstruction to respiration. So little is known of the physiology of the tonsil, especially of its capsule, that its removal except for cause must be earnestly deprecated. He is prepared to except cases of submerged, adherent or cryptic tonsils where recurrent inflammation supplies an operative indi-

cation, but otherwise in the great majority of cases he favors only partial removal, and concludes thus: "More care in the sifting of 'tonsils' and the deliberate choice of an appropriate operation rather than indiscriminate application of a single one because it is radical, are what must be insisted on in the interest both of patients and of our art." *Harris.*

**Diffused Peripharyngeal Phlegmon or Senator's Disease. Report of a Case.**

BAR (*Revue Hebdomadaire*, July 31, 1909). The patient was a robust man of 68 years of age, who, two days before Bar saw him, had been seized with a sore throat which, originally of slight severity, soon took on the appearance of a phlegmonous peritonsillitis. Incision into the swelling, however, did not evacuate any pus, but only dark blood. The following day the patient was better, but that evening the swelling had attacked the right side of the throat as well. Also on the outside the neck had become more swollen on that side. The temperature was somewhat elevated, but there were no chills. The day following, respiration became difficult and painful. That night the pharynx showed a bright red color, the soft palate was swollen and the uvula edematous. Incision into the palate gave rise to no pus. Capillary intestinal hemorrhage, epistaxis and dysuria followed. Examination of the exudate showed staphylococci and the diplococci of Fraenkel. Anti-toxin was used without avail, and the patient died the following day.

The author makes the following resume: Peripharyngeal phlegmon constitutes an entity of exceptional gravity and great rarity, the diagnosis of which is difficult. At its onset it presents nothing beyond an ordinary sore throat. Then it resembles a peritonsillar inflammation, and in its final stage, associated with Loeffler's bacilli and also streptococci, staphylococci, diplococci or pneumococci of Friedlander, which are the primary organisms, can be mistaken for a malignant diphtheria. This disease is in its nature a phlegmatic inflammation which spreads throughout all the superficial and deep tissues of the pharynx without presenting in any one region a true collection of pus. The result is almost invariably fatal. Its evolution is very rapid, death occurring in three or four days. The patient usually only suffers with a little fever, some-

times with a subnormal temperature, throughout the entire illness, and succumbs to cardiac failure or some complication due to septicemia. *Harris.*

#### Disorders in the Adult Arising from Embedded Tonsils.

TRETROP (*Revue Hebdomadaire*, August 28, 1909). A series of four cases is given illustrating unusual symptoms arising from embedded tonsils, the tonsillar origin of which is wont to be overlooked by the general practitioner. Bezancon has already pointed out that "a diminution of the vascular murmur at the apex of the lung, especially at the right apex, without modification of the percussion sound, can occur in persons suffering from insufficient nasal respiration, adenoids, enlarged tonsils, etc., and believes that if no other symptom of tuberculosis exists it is necessary to believe in the existence of functional insufficiency of the upper right lobe of the lung, due to interference with nasal respiration or to certain other causes which may escape us and which it is important to discover."

The author believes that "certain other causes" here referred to he has discovered in a bound-down tonsil, and as a result of his observation a diseased tonsil can produce cough, expectoration and diminution of the vascular murmur. Inflammatory process in the tonsil can arise without any pain and only a little irritation in the throat, which does not demand attention. There results, however, a proliferation of the connective tissues of the tonsils and adhesions of the tonsils and pillars which become hypertrophied. The surface of the tonsil, however, is usually smooth. Superficial examination does not show a tonsil at all. Indeed the tonsil can be reduced in size. Accordingly, respiratory insufficiency cannot explain the symptom. Tretrop has seen cases where the tonsils were so small that he hesitated to intervene. Cough and secretion in the throat were the prominent symptoms complained of in the cases reported, and were ascribed by the local practitioner to a pulmonary condition. *Harris.*

#### A Case of Rhinopharyngocele.

BROECKAERT (*Revue Hebdomadaire*, December 4, 1909). The patient was a child of eighteen months. At the age of two months a swelling developed on the left side of the neck, which had gradually become larger. The growth could easily



be compressed, and up to the time that it had been seen by Broeckaeart had been held in place by a band around the neck. The child appeared entirely well, good color, normal respiration. In the neck behind the angle of the jaw a round tumor could be seen, about the size of an orange. The skin covering it was normal in appearance and could be easily displaced. Palpation showed a soft growth easily depressed. Under the influence of strong expiration or during coughing, crying, etc., it obtained its maximum size. It was reduced decidedly during a deep inspiration. By strong pressure it was possible to cause it to entirely disappear, but as soon as the pressure was removed it immediately reappeared. Examination of the oropharynx and larynx revealed nothing, but the finger introduced into the vault penetrated behind the tubal eminence into a very deep fossa extending outward. This could be nothing else than the fossa of Rosenmüller abnormally developed. The child was presented at a meeting of the Belgian otolaryngologists. Operative intervention was decided upon, but on account of an accident to the child was abandoned.

The author discusses at some length this interesting case. The high pitched percussion note, the extreme rapidity with which it expands under forced expiration, its softness and flaccidity all establish the diagnosis of an *ærocele*. Of still greater interest is the point of origin, whether from the larynx, pharynx or trachea. The result of the digital examination excludes the larynx and trachea and permits the growth to be regarded as a *rhinopharyngocele*. The author has not succeeded in finding a second case in the literature. As regards the pathogenesis, after referring to the possibility of arrested development and congenital predisposition, the author decided in favor of bronchial remains, and regards it most probable that the second branchial cleft from which the fossa of Rosenmüller and the tonsil fossa are developed is the point of origin.

Harris.

#### Septic Hemorrhagic Pharyngitis.

HERMAN MARSCHIK (*Monats. für Ohrenh. und Laryngo-Rhinologie*, XLIII, Jahrg., 1 Heft, p. 68) reports an interesting case of septic phlegmon of the pharynx and larynx, accompanied by submucous hemorrhages, which proved fatal within fourteen hours after the appearance of the local symptoms and twenty-four hours after the first suggestion of any



illness. All forms of treatment were absolutely useless, though a tracheotomy was done nine hours before death to relieve the dyspnea. The infection was streptococcic in origin, and there were no signs of any abscesses or purulent infiltrations except a suppuration of the left antrum of Highmore. The hemorrhagic areas were found on the palate, pharynx, and especially around the opening to the larynx, and there were some even in the trachea. In connection with the extravasation of the blood there was a serous and cellular infiltration reaching from the epithelium down to the deeper layers, muscles, etc. Wood.

#### The Treatment of Acute Lacunar Tonsillitis.

LAMANN (*Monats. für Ohrenheilkunde und Laryngo-Rhinologie*, p. 881, XLIII, Jahrg., 12 Heft, 1909) says that the chief object in the treatment of acute tonsillitis is the sterilization of the crypts, and he proposes to do this in the following manner: After having determined with the probe the different positions of the lacunæ, he takes a probe, the end of which is made of silver, and instead of being round, possesses a large, coarse screw. This instrument is dipped in chromic acid, which has become liquid by exposure to the air, and then carefully introduced into each crypt. Care must be taken not to touch the uvula, and as soon as the instrument is withdrawn the patient should wash the mouth out with clean water. Cases of phlegmonous angina, which have a tendency to occur, should be treated after the cessation of an attack by thoroughly disinfecting the tonsillar crypts with chromic acid. He says this will prevent a recurrence. Wood.

#### "Phlegmon Ligneux" With Throat Complications.

H. BRAAT. *First Case*.—A ten-year-old girl had two months ago a little pain in the throat and a thickening at the mandibular border; later hoarseness; since a couple of weeks a slowly developing swelling in front of the larynx. No interference with swallowing. The child was pale and pretty thin with some erythematous patches on the face. In front of the larynx is visible a hard, painless, immovable, sharply defined swelling. Below the left mandibular angle is a second swelling the size of a bean. Mouth and pharynx normal. A light reddish, hard and painless swelling of the entire left half of the larynx was

present; the sinus pyriformis was obliterated. The left false vocal cord showed near the vocal process a yellowish-gray spot, seemingly ulceration. Temperature normal. The child was healthy and cheerful. Three punctures in the pyriform sinus were negative. After a few days the swelling in front of the larynx became softer; at the right side two yellowish patches appeared, which after incision discharged a little thick pus, which contained strepto- and staphylococci. Then the swelling shrank and disappeared after six weeks. At the same time the swelling in the larynx and the red patches in the face disappeared. Discharge of the nearly recovered child after two months, without a definite treatment being instituted.

*Second Case.*—Observed two years ago in a 60-year-old man. He had a broad, immovable, sharply defined, painless swelling, hard as a board, developing slowly, probably after an angina. The uvula was very much thickened, and the root of the tongue was rather hardened and thickened—also, the right side of the pharynx. Recovery after a few months (report of the family physician).

*Third case* was that of a 40-year-old man, who came a few weeks ago for a swelling of the neck and trouble while swallowing, beginning after an angina four months previous. At the right side of the neck a swelling had slowly developed, which increased in size and hardness, while the right half of the tongue had become larger. In the last few weeks, trouble while swallowing, and emaciation; no pain, no fever. A swelling, 10 cm. broad, hard, painless, alongside of the sternocleido-mastoideus. The muscle itself was not affected, as appears from the good motility of the head. Below the chin a similar tumor of the size of a hen's egg and a smaller one at the left side of the neck. The right half of the tongue was swollen to its double size, was hard, movable, painless. Swallowing very difficult. The right pharyngeal wall was swollen and hard, also the right half of the border of the epiglottis.

Braat considered these three cases to be "phlegmon ligneux," as first described by Reclus (*Revue de Chir.*, 1896), due to a chronic inflammation of the connective tissue, caused by non-virulent pyogenic microbes. The rule is slow resorption and recovery. He believes that abstaining from active treatment is preferable, as apparently self-recovery is the rule.

P. Th. L. Kan spoke about the treatment of some affections

of the lacrimal apparatus by permanent drainage with a silk thread. As this same subject is treated exhaustively, from the ophthalmologic side, by Prof. Koster in v. Graefe's Archiv referent refers to these two articles.

Waller Zeper treated two patients in this way and is very well satisfied so far. It was not difficult to get hold of the thread introduced through de Wecker's canule. One sees the thread, which is pushed forward by an assistant, curling in the lower nasal passage. He tied one single thread to a single copper wire thread.

Mulder treated some cases with an oculist. He did not find the hooking easy. Removal of the lower turbinate was usually necessary. Twice the thread appeared not below, but above the lower turbinate; probably much probing had been previously done. He advises that the thread be pulled upward out of the canule.

Struycken pointed out that in many cases no canule could be brought through the nasolacrimal canal.

Kan objected to pulling the knotted thread through. Sometimes the nasolacrimal canal ends naturally above the lower turbinate. A false route can become, after the drainage treatment, a good one.

*Blaauw.*

#### IV.—LARYNX.

##### **Treatment of Various Affections of the Larynx by Sismotherapy.**

CONSTANTIN (*Archives Internationales de Laryngologie*, September-October, 1909). As the result of his experience, the author is of the opinion that sismotherapy can render the laryngologist, under certain circumstances, a very real service. The vibrations conveyed to the muscle fibers are wont to excite their contractility and produce a stimulation slight indeed, but of a pronounced efficacy. Acute aphonias, more or less complete, due to overuse or misuse of the voice, transient congestions of the chords without any apparent infectious cause, professional laryngeal neuroses, hysteric paralyses and possibly chronic nervous dysphonia of Brissaud are indications for its use. It is contraindicated in acute or chronic spasmodic affections of the larynx. The author has succeeded in a number of cases, suffering from one or the other of these conditions, in obtaining excellent results from mechanical massage.

*Harris.*



**Laryngeal Tuberculosis.**

ROBERT LEVY (*New York Medical Journal*, September 11, 1909) out of his very large experience gives his views at some length on this all-important subject. In treatment the remedy is of less importance than the method of application. Indiscriminate use of formaldehyde preparations for all cases must be condemned. An excellent preparation is a one per cent solution of methylene blue. Tuberculin injections have shown beneficial results in a few instances, but the number is not sufficient at present to warrant any deductions. The author concludes as follows:

"1. Pathologic condition of the laryngeal mucosa, especially chronic laryngitis, are important factors in the etiology of tuberculosis of the larynx.

2. Pain is not always present in laryngeal tuberculosis. When present it is not always conclusive that the lesion is tuberculous. It may exist without ulceration.

3. The beneficial effect of mercurial treatment in laryngeal lesions of tuberculous patients should not be accepted as positive proof of the value of the treatment in tuberculosis. It must be recognized that the differential diagnosis between syphilis and tuberculosis of the larynx is at times extremely difficult, especially when the former exists in tuberculous patients.

4. Bacteriologic confirmation of the diagnosis is often obtainable by examination of smears made directly from the laryngeal lesion.

5. It is necessary to again impress upon the general profession the curability of laryngeal tuberculosis. It is especially important that the prognosis be determined by a careful study of the lesion in all its characteristics.

6. Local treatment to be effective must be well selected, both as to time of applications and methods of procedure."

Harris.

**Actual Condition of Laryngostomy.**

SARGNON AND BARLATIER (*Revue Hebdomadaire*, September 11, 1909). A further contribution to this subject by Sargnon and his confrere, Barlatier. Since their last paper they have modified somewhat their operative technic. At present in all cases where it is possible they suture the larynx to the skin before making a section or resection of the cica-



trices. In this manner a better view is obtained and retractors are not necessary. In order to diminish the length of treatment the cicatrices are, as thoroughly as possible, excised instead of being merely incised, as was practiced at first. They also remove the remains of the subcannicular spurs, which are often grave obstacles to respiration and can be the cause of relapse. For all cases of cicatricial stenosis they still employ the rubber method after the first eight days, when the gauze tampon is made use of. Comparison of the result by means of gauze packing, in their judgment, shows the superiority of the rubber dilatation. They do not regard laryngostomy as a very grave intervention. In a case of tuberculosis operated upon by Dr. Berard, a small goiter was removed at the time of the laryngostomy. No tracheotomy was made prior to the operation. The operative results were excellent. Three to four months are usually required in order to obtain dilatation of the larynx. A sufficient amount of time should be allowed to intervene after the dilatation before the fistula is closed. In grave cases occurring in aged persons and people suffering from fever, where dilatation is rendered difficult, they no longer employ suture de rapprochement, but first do an immediate autoplasty in order to obtain primary union and to diminish the length of after-treatment.

Indications for laryngostomy are the same, in their opinion, as formerly. It is indicated in endolaryngeal cicatricial stenosis and is the method of choice. Their failure in internal dilatation in such cases has made them decide in favor of external operation. If the lesion is not cicatricial, especially if it is a papilloma, rubber dilatation is contraindicated. Gauze tampon is sufficient here; the object of the laryngostomy is not to make dilatation, but to establish a permanent opening and permit of treatment. In cases of recurring papilloma with complications of cicatricial stenosis they advise rubber dilatation, at least for a time.

They suggest making use of laryngostomy in certain forms of tubercular stenosis. In spite of their failure in the cases referred to, they are in favor of the operation, provided that the lungs are not seriously involved. They would not only make an opening in the larynx, but remove the diseased tissue and then close with a flap.

The results of the laryngostomies are most satisfactory. Out

of more than 70 laryngostomies they know of only six deaths, and some of these occurred after healing, and were not to be ascribed to the laryngostomy. Of the 18 cases upon which they have personally operated, three have died. One case was due to bronchopneumonia, one died six hours after the operation from asphyxia (a large thymus was found), and one case died of asphyxia at the time of suture. The respiration is good in all the cases they have operated upon, with the exception of one. In all the canula has been removed, except in two patients operated upon recently.

They conclude that laryngostomy is an operation entirely classical and constitutes the treatment of choice for grave cicatricial stenosis and recurring papilloma. *Harris.*

**Treatment of Cicatricial Stenosis of the Larynx by the Methods of O'Dwyer and Rogers.**

D. BRYSON DELAVAN (*Journal of Laryngology*, November, 1909). The paper of Delavan before the British Medical Association last year is one of the most important contributions to this subject. The pioneer work of O'Dwyer is referred to, and then the perfection of detail by Dr. John Rogers is carefully gone over.

Among the varieties of laryngeal obstruction to which the method is applicable are:

1. Cicatrices, traumatic, operative or inflammatory in origin.
2. Granulations around canula or intubation tube.
3. Hypertrophic subglottic laryngitis, most commonly encountered in retained tube cases.
4. Prolonged and repeated diphtheritic inflammation.

The principle upon which this treatment is based is that the interior of the larynx is a cavity or tube having rigid or inelastic walls and lined with various soft tissues liable to injury and therefore to the formation of cicatrices. Incision into the dense scar tissue will almost invariably reunite. Attempted removal of cicatrices in the larynx is not liable to be attended with success. Operations upon the larynx, whether within or without, tend in themselves to produce stricture. The cause of success in the treatment of these cases is in long-continued stretching of the scar tissue, which in time will lose its resiliency.

In order to produce satisfactory pressure on the cicatrix two things are absolutely necessary: (1) The instrument must

be adjusted with great accuracy to the shape as well as to the size of the stricture. The ordinary O'Dwyer tube will not answer this purpose. Each case must have its own tube. (2) The intubation instrument used must be large enough to exert the right pressure force on the contracted tissue. A properly constructed O'Dwyer intubation tube is almost a perfect instrument. It can be worn without harm to the patient for months or years.

Where autoextubation complicates the difficulties, a tracheal opening with a plug or clamp tube is necessary. Possible adductor spasm must be carefully considered, both for diagnosis and treatment. Under ether once in every three or four months the tube should be carefully removed and the respiration observed. If it is still completely or partially obstructed dilatation must be resumed, but if the breathing is natural and easy, spasm may be diagnosed. To overcome this, a tube with a neck as small as possible must be introduced.

A fibrous stricture is treated in the same way, with the exception of the primary dilatation in case the stricture is too tight to admit a tube. Under these conditions a tracheal fistula is usually present. Under general anesthesia urethral sounds are passed up and down until considerable resistance is encountered.

Reference is made to the statistics in 23 cases, many of them showing most satisfactory results after the persistence of the treatment.

*Harris.*

#### **A Chronophotographic Method for Studying the Resonants and Some of the Results Obtained.**

H. ZWAARDEMAKER. Taking the upper end of his ærodro-mometer in one nostril while m, n, or ng are pronounced, the instrument makes an incision, which can be registered chronophotographically. As demonstrated, projected curves show the extent of the excursion, and thus the velocity of the escape of air through the nose—larger for whispering than for normal speech. Comparison with the graphic of the changes in pressure in the nasopharyngeal cavity and of the curves of the motions of the palate directly taken by Prof. L. P. H. Eykman showed that a large part of the preceding and following consonant is spoken nasally. Rousselot and Eykman had reached this conclusion previously. The new method teaches



how to measure the escaping air. During the pronunciation of the word "Ammann" 7 to 12 cc. escapes through the right nose. Zwaardemaker had not had time for examination of pathologic cases, but assumes differences. The method will be of value in case of disturbing nasal sound without apparent disturbance of the palatal closure.

*Blaauw.*

**The Cutting in Two of a Large Steel Pin, While Transfixed in the Left Bronchus and Its Removal by Lower Bronchoscopy.  
A Bronchoscopic Pin-cutter and Fragment-holder.**

W. E. CASSELBERRY. A glass-headed,  $1\frac{1}{2}$ -inch, very sharp, steel pin was found by upper bronchoscopy to be immovably transfixed in the first bronchial branch, and across the left bronchus of a 15-year-old girl, and the manner in which this accident happened should be made generally known in order that so dangerous a method of dressing may be avoided.

The young woman, with pin in mouth and skirt in hand, in readiness to drop the skirt over her head, raised very high her outstretched arms—an act which is identical with the first movement in Sylvester's method of artificial respiration, which owes its power to the fact that raising the arms expands the lungs and causes an inrush of air, the mouth opening, itself, as if by instinct; and, at the same moment, to let the skirt fall clear of her hair, the head was thrown backward and face upward, bringing the mouth, larynx and windpipe into a straight vertical line, an attitude identical with the sword-swallower's position. The pin, let loose, simply dropped with the air current, head foremost, into the left main bronchus, and on downward till its head and two-thirds of its stem had passed into the first bronchial branch, where, being too long to quite make the turn, it was arrested, with its head compressed against an upturning segment of the bronchial branch, and its point against the opposite wall of the main bronchus. Both ends of the pin being against a barrier, the impact of cough had sufficed to drive its point firmly into the bronchial wall, and in this transfixed position it had remained, without causing serious discomfort, for ten weeks. Freedom from suffering for so long a period leads a patient to forget or to doubt the presence of a foreign body, and as the physical signs are indefinite when the object is but slightly obstructive, the X-ray,



supplemented by bronchoscopic inspection, may be the only means of positive demonstration. That the X-ray, however, has its shortcomings and really needs to be supplemented by direct observation through the bronchoscopic tube was made evident by a serious delusion in the interpretation of the first skiagraph of this case, an extraneous or false shadow "very like a pin," which appeared on the right side, having been at first accepted, as the sought-for outline, whereas the pin was lodged on the other side, its real shadow obscured in the shade of the sixth rib. Furthermore, nothing short of upper bronchoscopy could have disclosed the exact position and state of transfixion of this pointed object, a disclosure essential to devising a plan for its removal. At the first operation every effort was made through the bronchoscopic tube to displace the pin without cutting it. It was grasped at the depth of 11 inches, with various bronchoscopic forceps, the grasp being many times renewed to change forceps or vantage point of the grip, but without avail, except for the conviction that it must first be cut in two.

Based on the favorable result of the following procedure, it is proposed, as a general principle, in order to facilitate the bronchoscopic extraction of immovably transfixed pointed objects, such as pins, needles and perhaps open safety pins, first, to divide them, through the bronchoscopic tube, into two or more parts; and the instrument or pin-cutter devised for this purpose is described.

A valid criticism would seem to be the disposition of the parts of a pin, when cut, to fly asunder hence, possibly to drop out of sight or out of reach of the bronchoscopic forceps. But this contingency did not occur, for the beak-shaped, slotted, scissor-like cutting mechanism is so devised that one of the two fragments will adhere with dependable regularity and firmness in the serrated slit alongside the blade bevel, as long as the blades are not permitted to reopen, and moreover, the operator can elect the fragment to be so held by turning the blade. Therefore it was planned to minimize the risk of losing the smaller fragment by electing it to be held in the grasp of the pin-cutter.

It was deemed expedient, by reason of the novelty of the procedure, to operate this time by lower bronchoscopy, although it is now realized that the pin-cutter and the principle

of its use are applicable as well at the longer range of upper bronchoscopy. A few additional efforts to extract the pin without cutting having proven futile, the pin-cutter was passed down the bronchoscopic tube. It operated exactly as planned, one could hear the snap, see the larger fragment shiver and then discern the small, pointed piece in the beak of the instrument, held fast in which it was withdrawn, and in another minute, the larger piece, in the grip of a bronchoscopic forceps, came safely out.

*Author's Abstract.*

#### V.—MISCELLANEOUS.

##### **Nasopharyngeal and Laryngeal Symptoms in Syringomyelia.**

BAUMGART (*Berliner klin. Wochenschr.*, No. 34, 1909) reports a case in which the first suspicion of the disease was awakened by the laryngoscopic examination. The findings were as follows: Left posticus paralysis, slight right posticus paralysis with perverse movements of the vocal cords and descendant of the speech. Right-sided atrophy of the tongue. Movement of the right side of the soft palate less than the left. Knee reflex normal. This excluded tabes, and as there was only a one-sided atrophy of the tongue and no atrophy of the lips, bulbar paralysis was excluded and the diagnosis pointed to syringomyelia.

*Horn.*

##### **Dental Cysts.**

GERBER (*Archives Internationales de Laryngologie*, November-December, 1909). Dental cysts are not so rare as is usually supposed. Gerber has seen fifty in his own practice. The presence of serous fluid and the dilatation of the walls of the sinus are the most characteristic symptoms. He has rarely seen a dilatation of the nasal wall of the sinus. In advanced cases the diagnosis is easy, but in beginning cases often difficult. The pathognomonic sign in beginning cases is an elevation of the floor of the nasal fossa on the affected side in the anterior portion and the turning of the head of the inferior turbinate upward. At times between the inferior turbinate and the floor of the nasal fossa a tumor, more or less pronounced, can be seen, which, when touched with the sound, gives, but not always, a certain degree of resistance and fluctuation. A characteristic blue color is wont to follow the im-

pression of the sound. Finally Röntgen photograph is an additional aid in diagnosis. The histories are given of two cases operated upon according to the method of Partsch, modified by Gerber. This consists in the dissection of a flap, the base of which is attached to the alveolar process, and of which the free end is cut deeply from the mucosa of the cheek. The flap, having been dissected and elevated, the cyst is extirpated in its entirety, as far as possible, after which the mucous flap is placed in the bony cavity and held there by a tampon.

Harris.

**Foreign Body in the Esophagus and the Relative Value of Esophagoscopy and External Esophagotomy.**

MOURE (*Revue Hebdomadaire*, September 4, 1909). The value of the direct method for examination and removal of foreign bodies from the esophagus is well established. There are, however, cases where failure will be met with. Examples of these are cases where little children have swallowed coins. Occasionally Moure has been able to remove such coins by the direct method with the Killian seizing forcep. In other cases, on the contrary, by far the most numerous, the instrument will pass below the coin and enter the esophagus without allowing the foreign body to be seen or grasped. The children are often brought to us after operative manipulations in the throat have rendered the mucous membrane in the throat broken down by ulceration. The Kirmisson hook in such cases is a harmless instrument and decidedly to be recommended.

The case which the author reports is that of a young child  $3\frac{1}{2}$  years of age who, in the course of his play, had swallowed a toy anchor of iron. For some time no trouble in swallowing or respiration was noted. At the end of five days difficulty in swallowing started in, associated with copious salivation and coughing. Radioscopy showed the presence of a foreign body behind the cricoid. Under chloroform Moure attempted direct esophagoscopy, but the forcep passed directly into the bronchi without entering the esophagus. A second radiograph showed the presence of the anchor, 3 cm. long, with a transverse arm, placed perpendicular to the lower portion of the anchor. This was about on a level with the inferior sterno-clavicular junction, the inferior extremity directed toward the



left at an angle of 45 degrees, turned toward the posterior wall of the esophagus.

Moure made a second attempt by the direct method, and while he was able to seize the foreign body, did not dare use sufficient force to take it out. He accordingly proceeded to perform the external operation; no difficulty was experienced in removing the anchor by this method. There was considerable breaking down of the esophageal mucous membrane, and some suturing was required. An esophageal sound was introduced through the left nares for the purpose of feeding. A small drain was introduced into the lower portion of the wound. Satisfactory recovery.

The author concludes, the case is an interesting one, on the one hand because it demonstrates the inefficacy of esophagoscopy in certain cases, rare it is true, and on the other hand, the benefit of external esophagostomy in spite of the young age of the patient.

*Harris.*

**The Treatment of Cervical Tuberculous Lymphadenitis and Tuberculous Dermatoses by Means of the X Ray.**

RUSSELL H. BOGGS (*New York Medical Journal*, February 19, 1910). The results in the treatment of cervical tuberculous adenitis by means of the X-ray are so satisfactory that this method is deserving of a great deal more attention and serious consideration than has been given. The cosmetic results are better and the end results more permanent. The Röntgen ray appears to have a constitutional as well as a local effect. Crane's theory explains this satisfactorily. This may be stated as follows: "The immunizing substance set free under the influence of the X-ray is of necessity 'autogenous,' that is, it is formed from the actual microbic strain which is producing the disease." When a chain of lymphatics is rayed intensively they undergo a fibrous degeneration and almost entire obliteration without serious effect to surrounding tissue if the radiation is properly administered. If the glands are diseased, the reaction of the epithelial cells is much quicker and more marked. Tuberculous adenitis may be divided into three classes. First, where the glands are only slightly enlarged, it is a question whether they are tuberculous or not. Such cases frequently are seen after typhoid fever, measles, etc. The child is greatly emaciated. This class of adenitis



should certainly be treated by the X-ray, because every one of these patients can be cured. After the first twelve or fifteen treatments the local disease not only begins to improve, but the patient gains in health and weight. Suppurating glands should first be incised. This does not interfere with the radiation, and treatment should be begun the next day. Suppurating glands should be treated by the X-ray.

Second, cases in which the glands are of large size and have resisted ordinary treatment. These glands should be rayed intensely. At the end of three or four months they have usually undergone degeneration, are freely movable and are about one-fourth the size when treatment was begun. The Röntgen treatment is advised in these cases, because the apices on the affected side are nearly always involved, and if rayed intensely general tuberculosis will be prevented.

Third, in the treatment of over twenty-five cases of recurrence following operation, it was the experience that it is necessary to begin X-ray treatment more gradually. The first improvement is the gain in weight and general health. The Röntgen ray and Finsen light are established methods of treatment in lupus. One advantage of the Röntgen ray is that it takes less time to cure a lesion.

#### **Instruction in Speaking for Stutterers.**

A commission, consisting of the Drs. Moll, Mulder and Schutter, with the director of the deaf-mutes' institute at Groningen, Mr. Roorda, made a report, which was sent to the members, which treats the question of how to provide for instruction to stutterers. The commission prefers government schools with resident pupils and regular teachers, who limit themselves to instruction in speaking. This system has the following advantages: (1) The pupils are removed from the often hurtful influence of the home surroundings; (2) The time for instruction is longer, the superintendence more efficient; (3) Co-operation of teacher and specialists; (4) Treatment of the stutterers from the country. As example is the "Statensinstitut for Talelidende" at Copenhagen.

Burger warned against a too theoretic treatment of the question. Municipal courses in Germany have given pretty good results. The financial part must be considered.

Kan reported concerning Leiden, where a voluntary teacher

treats them. In the schools more notice is taken of speech defects than formerly. The result is that they are found less in the higher grades than in the lower. Municipal courses are less expensive and do a great amount of good. The government commission wishes to teach in the training schools the physiology of speaking and to institute ambulant courses for the country.

Van Anrooy mentioned that in Rotterdam such teachings are given in the training school. Teachers of the deaf-mutes institute are willing to give instruction free of charge.

Mulder, secretary of the commission, did not consider it to be the duty of the commission to draft a budget. The school in Denmark costs f. 15,000 (\$6,000). Faults in the pronunciation can be treated in the school. This improves with the development of the children.

Burger did not approve of the commission urging the establishment of a government school. The instruction for particular cases (blindness, deaf-mutism, idiotism) is given in Holland through private institutions. The right way would be to form a society for the starting of such a school, and if wished for, to ask for financial support from the government.

Ten Cate thought that the number of stutterers in the country is less than in the cities.

Mulder said that the commission did not inquire into it, but that the literature does not prove it.

Zwaardemaker thought that the knowledge of phonetics and musical talent would make a good practical pedagogue particularly apt for this kind of work.

Burger proposed that a pamphlet be sent out by the society to direct the public attention to particular teaching of stutterers. Mulder will do this on his own responsibility.

*Blaauw.*

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LIV.

THE SINUS MAXILLARIS AND ITS RELATIONS IN  
THE EMBRYO, CHILD, AND ADULT MAN.\*

BY JACOB PARSONS SCHAEFFER, A. M., M. D., PH. D.,

ITHACA.

This paper is based upon a study of the sinus maxillaris in the embryo in successive stages up to the fetus at term, as well as in the child and adult man. Most of the adult specimens ranged in age from 18 to 80 years.

The lateral nasal wall of the embryo, at different stages of growth, was modeled; thus showing the relations of the sinus maxillaris and its progress in development. The blotting-paper method was used in all the reconstructions. Both solid structures and cavities were modeled, thus securing positive and negative views.

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\*The American Journal of Anatomy, Vol. 10, No. 2, April, 1910.

The work also covers a general consideration of the sinus in the child and the adult; including a study of the sinus relations, its ostium or aperture, and the ostium accessorium. Special attention was also given to the cause and effect of recesses occurring on the walls of the adult sinus. Dissections were made to cover all phases of the problem.

In determining the size of the sinus the following measurements were taken: (1) dorsosuperior diagonal; (2) ventrosuperior diagonal; (3) superoinferior; (4) ventrodorsal; (5) mediolateral.

The capacity of the sinus was determined by filling the cavity with a portion of a previously measured liquid, or by measuring the amount of water the hardened mucous membrane (representing the exact shape and size of the sinus) would displace.

I wish to take this opportunity for expressing grateful acknowledgment to the heads of the Departments of Anatomy, and Embryology and Histology for valuable criticisms and helpful suggestions. I also wish to express my grateful appreciation of the abundant material and other facilities placed at my disposal by the aforementioned departments. To Professor and Mrs. Gage, for the loan of embryos from the research collection, I wish to express thanks.

#### THE EMBRYOLOGY AND EARLY RELATIONS OF THE SINUS MAXILLARIS.

About the tenth week of fetal life the mucous membrane in the primitive middle meatus of the nose begins to pouch laterally. This pouch represents the Anlage of the sinus maxillaris, which pushes from the originally simple furrow separating the maxillo-turbinal (later concha nasalis inferior) and the first ethmo-turbinal (later concha nasalis media).

In order to gain a clearer conception of the location and relations of this primary maxillary pouch, and to better interpret adult conditions, a brief consideration of the lateral nasal wall, of the embryo, is necessary.

During the second month of intrauterine life, before the cavum nasi and the cavum oris have become separate cavities, we find three swellings on the lateral wall of the nasal fossa (maxillo-turbinal, appearing first; ethmo-turbinal, appearing



next; naso-turbinal—extremely rudimentary in man, appearing later (Fig. 1). The maxillo-turbinal corresponds to the adult concha nasalis inferior. The naso-turbinal, which is termed by Peter and others, “der Agger nasi,” and by Killian, in conjunction with the primitive processus uncinatus, “der erste Hauptmuschel,” persists in the adult as the agger nasi. The ethmo-turbinal undergoes subdivision, and by this division, according to Killian, five ethmo-turbinal plates, defined by six grooves, are usually formed. E. Kallius says, “Dass alle diese 6 Furchen ausgebildet sind, ist selten.” Zuckerkandl’s investigations show that three ethmo-turbinal plates are the typical number. He says, “Drei Siebbeinmuskeln repräsentieren demnach die typische Faltungsweise des Siebbeines.” According to the embryos studied for this paper, I find that the number of furrows and ethmoidal conchæ varies, but in the specimens examined, four plates are rather common. The ethmo-turbinal plates and the resultant furrows become reduced in number as development goes on, and finally represent the conchæ nasales, media and superior, and the meatus nasi, medius and superior, respectively. The reduction in number may not be carried so far, and this accounts for the supernumerary ethmoidal conchæ and meatus in many adults.

Just how the primitive nasal processes and furrows are formed is interpreted differently. Some claim that the projections are due to an inpushing of the lateral nasal wall by the cartilaginous strands which become the nasal conchæ. This latter claim I have been unable to verify, because I find that the folds or projections are invariably present before cartilage is found in them (Fig. 1). The elevations at first consist of a duplication of the ectoderm with indifferent mesenchyma, which, in part, later changes into cartilage. The nasal conchal cartilages are, therefore, a result and not a cause of the early condition. Schönemann claims that they are elevations left by excavations of furrows on the lateral wall of the nasal fossa. Killian and Mihalkovics hold that the projections are free ingrowing folds on the lateral wall of the nasal fossa. Glas concludes a discussion on the nasal conchæ in rats thus:

“Die Bildungsmodus der Muscheln ist die Resultierende zweier Komponenten; (1) des Auswachsens in die Wandpartien einwachsender Epithelleisten (Fissuren). (2) des Vorwachsens bestimmter Wandpartien.”

After a study of these early conditions I am led to believe that the primitive furrows are primarily the result of an outpushing or outgrowing of the mucous membrane on the lateral wall of the nasal fossa. The projections, by a thickening of the mucous membrane (especially true in the ethmo-turbinal region) (Fig. 1), and the deepening of the furrows, become rapidly prominent. At times the two processes, an outgrowth or outpushing and a thickening of the intervening mucous membrane and mesenchyme, seem to be at work simultaneously in forming the early projections and furrows. The theory that the furrows are primarily started as an outpushing or outgrowing of mucous membrane is entirely in accord with, apparently, similar processes taking place in the early embryo nose; namely, the pouching or outgrowing of the mucous membrane as the Anlagen of some of the sinus paranasales. That a similar process should cause the formation of primarily similar outgrowths seems plausible.

It is, however, not the province of this paper to speak in detail of the development of the early projections and furrows; suffice it to say that it is from the furrow separating the primitive conchæ nasales, inferior and media, that the maxillary pouch evaginates. It is, therefore, the primitive meatus nasi medius with its contained structures, and the naso- and first ethmo-turbinals that especially concern us in the development and relations of the primitive sinus maxillaris.

Killian terms the naso-turbinal and the subdivisions of the ethmo-turbinal, "Hauptmuscheln;" and the smaller projections appearing in the furrows between these "Hauptmuscheln," as "Nebenmuscheln." What he terms "die zweite Hauptmuschel" will be spoken of in this paper as the concha nasalis media (first ethmoidal concha).

The naso-turbinal plus the processus uncinatus and the concha nasalis media have marked bends, thus presenting ascending and descending crura. Correspondingly the furrow between these conchæ has a bend, and presents ascending and descending limbs. For the sake of description we will consider the processus uncinatus as the descending crus of the naso-turbinal. The primitive meatus nasi medius has, therefore, as inferior boundaries the crura of the naso-turbinal and the space existing between the conchæ nasales, media and inferior. The superior boundaries of the space are the crura

of the concha nasalis media (zweite Hauptmuschel of Killian) (Fig. 4). To say then, as has been done earlier in this paper, that the maxillary pouch evaginates from the space separating the primitive conchæ nasales, inferior and media, is not giving the pouch its definite location.<sup>1</sup> The actual point of this primary pouching is from the primitive infundibulum ethmoidale, or the "unterer Recessus des absteigenden Astes der ersten Hauptfurche" of Killian.

This pouch is a minute epithelial sac, and forms the Anlage of the sinus maxillaris. Its earliest establishment precedes the appearance of the cartilage which later surrounds it. This is in accord with the statement of E. Kallius, that:

" \* \* \* die Nebenhöhlen der Nase schon angelegt sind, ehe der Knorpel entsteht, und dass also das Skelett sich erst sekundär um jene herumlegt."

According to my observations the earliest evidences of maxillary pouching are found about the seventieth day of fetal life. Kallius places the time of the primary evagination during the middle of the third month, "Die Oberkieferhöhle erscheint in der Mitte des 3. Monats." J. Kollman places the time of pouching later, "Seine Anlage beginnt erst bei Foeten Von 8 cm. Länge." Gegenbaur quotes Dursy as authority for the following:

"Schon bei 8 cm. lange Embryonen buchtet sich der Raum der Nasenhöhle zwischen mittlerer und unterer Muschel gegen den hier verdickten Knorpel der Seitenwand der Nasenhöhle aus und bildet die Anlage des Sinus Maxillaris."

I have found the primitive maxillary pouch duplicated, i. e., two pouches growing laterally side by side. (This may explain some of the duplications of the adult ostium maxillare—the two primary pouches fusing distally, leaving the two points of evagination as the ostia maxillaria of the adult sinus. Other duplications of the adult ostium may be caused in a manner similar to the formation of the accessory ostium.)

This embryonal condition probably explains some of the cases in which the sinus maxillaris is divided into two partially or wholly separate compartments by a vertical partition, i. e.,

<sup>1</sup>The relation of the space existing between the conchæ nasales, inferior and media, to the descending ramus or limb of the first furrow is spoken of thus by Killian, "Der Raum zwischen zweiter Hauptmuschel und unterer Muschel ist demnach nur eine Art Vorhof zum absteigenden Theil der ersten Hauptfurche."



each pouch developing into an adult cavity independent of its mate. (See subsequent paragraph.)

The primary ostium maxillare varies greatly in its dimensions in different embryos (Figs. 2, 3). This is entirely in accord with adult conditions, since the ostium of the adult sinus has a great range of dimensions (Table D). The great differences in the dimensions of the ostium may be due to early fusion of two or more primary maxillary pouches; or the primitive pouching may have been single, but extensive, as is frequently the case. These two latter would give rise to long slit-like ostia, while the single and less extensive pouching would give us the typically shaped and average sized adult ostium.

Some time prior to the establishment of the maxillary pouch<sup>2</sup> a ridge appears immediately inferior to the point of maxillary evagination. This ridge is the Anlage of the processus uncinatus and, as said before, will be considered, merely for the sake of description, as the descending crus of the nasoturbinal. It will be recalled that Killian terms the latter two structures, "die erste Hauptmuschel." This ridge has its free border directed superiorly, and it extends in a ventrosuperior direction. It early tends to form a shallow groove immediately superior to it, which is the primitive infundibulum ethmoidale (Recessus inferior des absteigenden Astes der ersten Hauptfurche of Killian). To be accurate, then, we must say that the maxillary pouch evaginates from the primitive infundibulum ethmoidale—a part of the meatus nasi medius.

Some time after the appearance of these structures there is a more or less uneven bulging on the lateral wall of the primitive meatus nasi medius, immediately superior and lateral to the free border of the processus uncinatus (Fig. 4). This is the Anlage of the bulla ethmoidalis. The slit-like space existing between the free border of the processus uncinatus and the bulla ethmoidalis is the primary hiatus semilunaris. Through this slit the infundibulum ethmoidale communicates

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<sup>2</sup>It is indeed difficult, in some cases, to say which structure is the primary one in establishing an Anlage. In most cases the processus uncinatus is the first to appear, and in some instances it is impossible to say whether the pouching of the mucous membrane, or the formation of the ridge is first. It may, however, be said that both structures are more or less dependent upon each other in establishing Anlagen.



directly, and the primitive sinus maxillaris indirectly, with the meatus nasi medius.

Killian subdivides the uneven thickening on the lateral wall of his "Ramus decedens der ersten Hauptfurche" into small projections with very shallow intervening furrows. The projections are his "absteigende Nebenmuscheln," and the furrows the "obere und untere Zwischenfurchen" of the first furrow, or the primitive meatus nasi medius. He concludes that the bulla is formed by the early fusion of some of the processes (Nebenmuscheln). The space immediately inferior to his "untere Nebenmuscheln," or the space he designates as the "Recessus inferior" of his first chief furrow, is the infundibulum ethmoidale—the exact place of the primary maxillary pouching.

At this juncture mention must be made of the primary pouching of the sinus frontalis in order to interpret later conditions in connection with adult frontomaxillary relations. It will be remembered that the furrow from which the maxillary pouch evaginates has ascending and descending rami, and that from the descending ramus the maxillary evagination takes place. The ascending ramus of this furrow widens and pushes ventrally and superiorly. Turner says:

"It is generally held that the frontal sinus commences to develop at the end of the first or the beginning of the second year of life, as an upward expansion of the ethmoid cell labyrinth."

Hartman quotes Steiner for the following:

"Der erste Anlage der Stirnhöhle ist in der Anlage des knorpeligen Siebbeinlabyrinthes gegeben. Mit der Entwicklung der zelligen Räume des vorderen Siebbeinlabyrinthes beginnt auch die der Stirnhöhle, denn letztere stellt eben nur die Ausdehnung der vorderen Siebbeinzellen nach oben dar."

Hartman makes the following statement:

"Aus dem aufsteigenden Ast der ersten Hauptfurche bildet sich durch oberflächliche Verwachsung eine sackartige Bucht, der Recessus ascendens od. R. frontalis, die Stirnbucht. Aus der Stirnbucht entwickelt sich die Stirnhöhle."

The embryos studied showed evidence of a slight pouching at the superior and ventral end of the primitive meatus nasi medius. This doubtless corresponds to the "Recessus frontalis" of the first chief furrow of Hartman and Killian.

According to Killian's commendable work there are three processes and four furrows on the lateral wall of the recessus frontalis, which are designated by him as "Stirnmuscheln und Stirnfurchen," respectively. The furrows, according to Killian, form the Anlagen of the cellulæ ethmoidales anterior, or cellulæ frontales, as some call them. From this he concludes that the sinus frontalis may continue its development in one of the following ways: (1) by extension of the frontal recess (direct method), (2) by extension of a frontal cell (indirect method), (3) by extension of the frontal recess and a frontal cell, (4) by extension of two frontal cells. With these facts kept in mind—allowing for further differentiation during development—it is easier to understand why the sinus frontalis, in the adult, connects either with the infundibulum ethmoidale, with the meatus nasi medius, or with both. These embryologic facts are of importance in connection with adult fronto-maxillary relations. Doubtless more work should be done on the development of the nasofrontal duct in order to clear up some points in connection with the relations existing between the sinus frontalis and maxillaris. I am now working along this line and hope to report my findings at some future time.

Although the pouching to form the recessus frontalis, or what may be termed the Anlage of the sinus frontalis, begins during the third month of fetal life, as does that of the sinus maxillaris, the extension of the sinus frontalis is for a time so small that it is usually regarded as wanting at birth. This is in part due to the fact that the sinus frontalis is as a rule looked for in the frontal or vertical portion of the frontal bone, while the first evidences of it are to be sought elsewhere. In fact, according to Lothrop's investigations, the sinus frontalis of the adult does not reach the vertical or frontal portion of the frontal bone in about three per cent of cases—the only evidences of the sinus appearing in the horizontal or orbital portion of the frontal bone. It must, however, be said that the sinus frontalis is tardy in its development until after birth; while, on the other hand, the pouch forming the Anlage of the sinus maxillaris develops more rapidly and occupies a definite space in the lateral wall of the nasal fossa by the end of the third fetal month (Figs. 2, 3).

By the simultaneous processes of resorption of surrounding tissue and the growth of the maxillary pouch, the primitive

cavity gains more and more capacity. The pouch soon acquires a slit-like shape at the side of the nose (Fig. 4). It has its greatest measurement in the ventrodorsal direction, while mediolaterally the cavity occupies comparatively little space. In embryos aged from 100 to 105 days the ventrodorsal measurement is about 2 mm. (Fig. 2). In a 120-day embryo the distance is about 2.5 mm. (Figs. 3 and 5A). In a 100-day embryo the most ventral spur of the sinus is about 6.5 mm., and the most dorsal spur 8.5 mm. from the tip of the nose.

It will be remembered that, in the embryo, the processus alveolaris of the maxilla is in proximity to the orbit, and when we recall the fact that the unerupted teeth are contained in this situation, it at once becomes evident that the sinus maxillaris must be correspondingly small at this time. Because of these facts the sinus of a 7-month fetus measures only 5 mm. in the ventrodorsal plane, while that of a fetus at term has increased this distance to approximately 7 mm. (Fig. 5B). During the latter month of intrauterine life the sinus gains in the mediolateral plane, so that at term this distance measures from 3 to 4 mm.

It is generally stated that the deciduous teeth hold the sinus maxillaris in check, and that the cavity rapidly assumes larger dimensions as the first dentition progresses. I, however, find that the growth of the sinus is rather uniform, and that the first dentition has little to do with any rapid increase in the size of the cavity. The age of the child and the size of the sinus, apparently, progress *pari passu* (Fig. 6).

The ventrodorsal measurement of the sinus in a child aged 6 months is 10 mm., but the cavity has not developed sufficiently in the mediolateral plane to reach beneath the orbit. In a child of 9 months the ventrodorsal distance is 14 mm., with a superoinferior measurement of 5 mm. At the end of the first year the sinus has reached a ventrodorsal measurement of 16 mm., a superoinferior of 6 mm.; and has now reached a mediolateral point sufficient to pass beneath the orbit. As the maxilla grows, the sinus remains for some time on the medial side of the infraorbital canal (Fig. 10). By the twentieth month the sinus measures ventrodorsally 20 mm. (Fig. 5) and has, as a rule, extended above the rudimentary first permanent molar tooth.

Before and during dentition the sinus maxillaris is sepa-



rated from the front of the maxilla by the unerupted teeth (Fig. 17). After the eruption of the deciduous teeth the cavity continues to have a more or less rounded and elongated shape (Fig. 5D). It is really never spherical, as is often stated, but has an irregular elongated form from the beginning.

After the eruption of the permanent teeth the sinus begins to lose its rounded and elongated shape and to assume the adult pyramidal form (Figs. 7, 8 and 9). By the twelfth or fifteenth year of age, when the second molar has appeared, the sinus approaches, though it has not yet attained its definite shape. The sinus reaches its full size between the fourteenth and eighteenth year.

#### THE ADULT SINUS MAXILLARIS.

The adult sinus maxillaris was known to Galenus (130-201), but apparently Dr. Nathaniel Highmore was the first to give any detailed description of it. In his work (1651), "*Corporis Humani Disquisitio Anatomica*," he describes the cavity in the maxilla, to which his attention was drawn by a lady patient, in whom an abscess of this cavity, since known as the antrum of Highmore (sinus maxillaris), was drained by the extraction of the canine tooth (left). The following are the exact words of Dr. Highmore in describing the cavity located in the body of the maxilla. His report of the case also follows:

#### "ANTRUM MAXILLAE SUPERIORIS."

"Antrum hoc utrinque unum, sub oculi sede inferiore ubi os ad oculum tutelam quodammodo protuberat, ad latera inferiora nasi situm est. Insigniter cavum sphaericum, aliquantulum vero oblongum, et ita amplum ut articulus pollicis majoris pedis ultimus in illo delitescat, \* \* \* Osse attenuata seu squamâ osseâ obtegitur: Os enim quod illud includit, et quod a dentium alveolis extremis distinguit, crassitie chartam Emporeticam non multum excedit. \* \* \* In basi hujus protuberantis quaedam eminentiae cernuntur. \* \* \* Quibus dentium apices tenniores includuntur. \* \* \* Dentium alveoli margini hujus ossis inferiori insculpuntur, quibus dentes infiguntur. \* \* \* Antrum hoc frequentius vacuum, aliquando muco repletum reperitur, in quod humores a capite per



meatum quendam a cavitate illa in osse frontis, et ab osse ethmoide destillare poterunt. \* \* \*

"Atque hic silentio praeterire non possumus, quod generosae cuidam foeminae sub nostra cura laboranti accedit. Cum sub ferina eaque continua falsi humoris distillatione, per multos retro annos laborasset, omnesque pené dentes corrosos ac cariosos evulserat; nec tamen a dolore liberata, tandem dente canino sinistri lateris effosso \* \* \* Simul squamosa illa distinctio inter cavitatem hanc et dentis foveam eriptur, adeo ut humorum, per alveolum dicti dentis, ab antro illo perrenis successerit destillatio; Qua multum perterrita, stylo argenteo in alveolum immissa originem fontis hujus exploratura, usque ad oculum, per uncias pené duas sursum adegit; magis adhuc metuens, pennam minorem plumis decerptis totam pené ad longitudinem palmae unius immisit. Iam maximae consternata, ad Cerebrum usque decurrere existimans, me inter alias consulit; ubi autem singulas examinavimus circumstantias, pennae reduplicaciones, illamque per cavitatem hanc circumgyrare invenimus. Atque sic, ubi in figura sequenti cavitatem hanc designavimus, illam de usu ac necessitate hujus satis instructam, perennisque illius fontis patentissimam habuimus, a timore et medicina simul desistit.

"Antrum hoc levitatis ossium causa, quae hic oculorum situs gratia crassa esse debuere, factum esse arbitramur."

The antrum (sinus maxillaris) described by Highmore must have been an exceptionally large one, because the canine tooth does not as a rule come in relation with the sinus. This same tooth is mentioned by some writers even to-day as the tooth to extract in draining the sinus. It is a very bad tooth to select for this purpose in the great majority of cases. This fact will be referred to in a subsequent paragraph when considering teeth relations. It will also be noticed that Highmore had a somewhat faulty idea of the shape of the adult cavity. He, however, mentions some very essential conditions in his descriptions of the adult sinus. His consideration of the cavity is very brief and many important factors are omitted. His report of the case through which his attention was called to this cavity, is unique and interesting.

The adult sinus maxillaris, as we know it, is the large cavity within the body of the maxilla. It is the largest of the

sinus paranasales, save in exceptional cases, when it is comparatively small and may be exceeded in size by the sinus frontalis and the sinus sphenoidalis. It lies lateral to the cavum nasi and resembles in shape a three sided pyramid (Fig. 7). It follows in the main the shape of the body of the maxilla; and may be described as having a roof, a floor and three walls. The walls of the sinus vary in thickness, usually from 5 to 8 mm.; but they may be reduced to a papery delicacy. The base or median wall is directed toward the cavum nasi, and the apex of the sinus extends into the root of the processus zygomaticus of the maxilla. It may even extend into the maxillary border of the zygomatic bone; thus extending the recessus zygomaticus of the sinus maxillaris.

The ventral wall of the cavity corresponds to the anterior or facial surface of the maxilla, and looks ventrolaterally. Part of this wall is at times greatly approximated to the dorsal wall and base of the sinus, due to a very prominent fossa canina. Occasionally the whole ventral wall bulges markedly into the cavity of the sinus.

The dorsal wall of the sinus corresponds to the infratemporal surface of the maxilla. It is a thin plate of bone, also forming the ventral boundary of the infratemporal and the pterygopalatine fossæ. This wall is usually the thickest of the sinus walls—it is, however, occasionally extremely thin (the processus alveolaris being recognized as the floor of the cavity and not as a wall).

The base or median wall is directed towards the cavum nasi. It presents a very irregular orifice—hiatus maxillaris, in the disarticulated bone. In the articulated skull this opening is partly filled in by the pars perpendicularis of the palate bone, the processus uncinatus of the ethmoid bone, the processus maxillaris of the inferior nasal concha, and a portion of the lacrimal bone. In the undissected state this irregular aperture formed by these bones is rounded by mucous membrane, which is continued into the sinus maxillaris from the cavum nasi. This rounded opening—ostium maxillare, may be duplicated; and such duplication must not be confused with the ostium maxillare accessorium, which is a direct passageway between the sinus and the cavum nasi. The ostium or ostia maxillaria establish a communication between the sinus and the infundibulum ethmoidale. The medial wall immedi-

ately inferior to the attachment of the concha nasalis inferior is very thin and is easily punctured in this region. This wall also forms the lateral boundary of the cavum nasi and often markedly encroaches upon the cavity of the sinus maxillaris, which greatly influences its size.

The roof of the sinus maxillaris is a very thin plate of bone, at times of a papery delicacy. It also forms the floor of the orbit and the orbital surface of the maxilla. It is often modeled by a ridge formed by the infraorbital canal. In some cases the ridge is replaced by a groove which is covered over with the mucous membrane of the cavity. At times the roof of the sinus is partially divided into two plates separated by air cells. Occasionally the palate bone aids in forming the roof.

The floor of the sinus is formed by the processus alveolaris of the maxilla. It is by far the thickest of the osseous boundaries of the cavity—the thickness of the floor depending upon the degree of hollowing out of the process. In cases where the hollowing out has been carried far, the floor of the sinus will bear an important relation to some of the teeth and their sockets. The floor of the sinus may be thrown into irregular elevations by the fangs of the teeth—this depending upon the thickness of the layer of spongy bone. This layer varies in thickness in different skulls, and there may be considerable asymmetry on the two sides of the same skull. The relation of the teeth will be considered in a subsequent paragraph.

#### THE RELATION OF THE SINUS FLOOR TO THE NASAL FLOOR.

The relation of the floor of the sinus maxillaris to the floor of the nose depends largely upon the degree of hollowing out of the processus alveolaris of the maxilla. The degree of arching of the palatum durum—thereby affecting the floor of the nose, has also some bearing on this relation. When the layer of spongy bone is thin, i. e., the processus alveolaris of the maxilla markedly hollowed out, the floor of the sinus is at a level inferior to the nasal floor. On the other hand, when the processus alveolaris is comparatively thick, the floor of the nose is inferior to the sinus floor. Occasionally both floors are in the same plane (Figs. 8, 9 and 11). When the anterior surface of the maxilla and the lateral wall of the nose are



markedly bulging toward the sinus maxillaris, the floor of the nose is, as a rule, inferior to the floor of the sinus. It, however, remains that the majority of sinuses have their floors, at varying distances, inferior to the floor of the nose. Sixty adult specimens were examined to ascertain this relation, with results as appended:

Number examined	Sinus floor inferior	Nose floor inferior	Same level
60	39	12	9

The difference in levels of these two floors, when not in the same plane, varies from one-half to 10 mm. C. Renschreiter says that it is a male characteristic to find the sinus floor at an inferior level to the nasal floor. I have, however, been unable to verify this statement, and give the following as typical of my findings:

Number examined	Sinus floor inferior	Nose floor inferior	Same level
12 (female)	9	2	1

#### RELATION OF THE SINUS MAXILLARIS TO THE TEETH.

Since the sinus maxillaris varies greatly in size in different skulls, and on the two sides of the same skull, it at once becomes apparent that the relations of the teeth to the sinus cannot be constant. As stated before, the layer of spongy bone between the roots of the teeth and the floor of the sinus varies in thickness in different skulls, and the asymmetry on the two sides of the same skull is at times marked. When this layer of spongy bone is comparatively thin the projecting tooth fangs form elevations, of a greater or less degree, on the floor of the sinus. These elevations at times aid in recess formation (Fig. 16). Direct communication between the fangs of the teeth and the mucous membrane of the sinus, due to extreme hollowing out of the processus alveolaris of the maxilla, occurs most frequently in the aged (Fig. 15). This latter condition does, however, occasionally prevail in the young adult (Fig. 16). That very intimate relations frequently exist between the teeth and the sinus maxillaris is a fact that we should be cognizant of, but I find that these intimate relations have been somewhat exaggerated by some writers.



The number of teeth that bear a direct relation to the sinus is necessarily inconstant, as stated before. In exceptional cases, when the cavity is very large—especially in the line of the ventrosuperior diagonal, all of the teeth of the true maxilla may be in relation with the sinus (Fig. 15). It is, however, only an occasional occurrence to have the canine in direct relation with the sinus. In a certain number of cases the first premolar tooth bears a direct relation to the cavity, and in a slightly larger percentage of cases the second premolar bears a similar relation. The three most constant teeth, however, in direct relation to the sinus are the three molars. When the sinus maxillaris is small the first molar must be omitted from the direct relation (Figs. 12 to 16).

It is a fairly safe rule to follow, that, when the canine fossa and the lateral nasal wall are simultaneously approximated, the canine and premolar teeth do not bear a direct relation to the sinus maxillaris. In such cases a perforator pushed through a premolar tooth socket might readily enter the lateral nasal wall—even pass through it, passing entirely free of the sinus cavity. Again, if the perforator were pushed through the lateral nasal wall, inferior to the concha nasalis inferior, the instrument could readily be pushed through the soft structures of the cheek, unless the point were directed well superodorsally.

#### RIDGES, CRESCENTIC PROJECTIONS, AND SEPTA ON THE SINUS WALLS.

It is important to note how frequently the walls of the sinus are found uneven. These irregularities may consist of mere ridges or of different sized crescentic projections. The crescentic projections have been reported occasionally replaced by septa which completely divide the sinus into two cavities, each having its independent opening into the nasal fossa, but not communicating with each other (Fig. 22). The smaller ridges are of little consequence and may be omitted from further consideration. The larger ridges and crescentic projections, on the other hand, tend to form pockets and recesses, of varying depths, within the cavity. The septa, when they exist, may be placed either superoinferiorly or ventrodorsally; thus forming either ventral and dorsal, or

inferior and superior compartments, respectively. According to Zuckerkandl's findings, the superior and dorsal cavities communicate with the meatus nasi superior, and the ventral and inferior cavities with the infundibulum ethmoidale. Brühl found the inferior compartment communicating with the meatus nasi inferior. Gruber found a complete division of the sinus maxillaris in 2.5 per cent of cases.

In the material used for this paper no sinus was found showing division into two distinctly separate compartments, but the specimens repeatedly showed crescentic projections and ridges which formed pockets of a greater or less depth (Figs. 18 to 23).

Sixty sinuses were examined to cover this phase of the work, with results as follows:

Number examined	Ridges or crescentic projections	Sinus walls even
60	29	31

It must be borne in mind that, in the 29 positive sinuses, quite a number of them showed mere ridges—the latter will be omitted from further study. The remaining number of the positive group fall, however, into a very important class of specimens. That these crescentic projections offer, at times, almost insuperable obstruction in attempting to drain fluid from the sinus through an opening either in the processus alveolaris, or in the meatus nasi inferior, is a fact that we should be cognizant of. This was repeatedly demonstrated by first filling the sinus with a liquid, then making an opening at some point on the processus alveolaris; thus draining out what would come away. If some of the fluid was retained—allowing for adherence to mucous membrane—the facial or anterior surface of the maxilla was removed to find where the remaining fluid was lodged. As a rule the portion of fluid was retained by a recess or recesses on one or more of the sinus walls. At other times a second and even a third opening was made, either through the alveolar border or through the meatus nasi inferior, before the remaining fluid would come away. If after repeated attempts the fluid could not be located, the ventral wall of the cavity was removed to ascertain the reason for its retention, and the fact was thus demonstrated that repeated punctures, in some cases, would not reach all of the recesses.

Just what these recesses mean in all cases is difficult to say. Some of them are, of course, formed by elevations caused by tooth fangs, but these, as a rule, are of minor importance and only occasionally form deep recesses. Others are formed by projections of mucous membrane, which may or may not be caused by crescentic bone projections. Where complete septa exist, the sinus maxillaris very likely developed from two primary pouches. In some cases the intervening wall may have disappeared in part, thus leaving the larger crescentic projections which occasionally are found in the adult sinus. A double pouching of the primitive sinus maxillaris was mentioned in a previous paragraph on the development of the cavity. Unequal resorption of the bone during the growth of the sinus is doubtless a cause for some projections occurring on the walls of the cavity.

#### THE SIZE OF THE SINUS MAXILLARIS.

The sinus maxillaris varies greatly in size in different individuals. There may also exist considerable asymmetry on the two sides of the same individual. The statement that all old people have large sinuses is very fallacious, as is also the statement that all females have smaller sinuses than males (tables A, B, C).

The investigations of Zuckerkandl have shown that enlargement of the sinus maxillaris may be produced by:

*a.* Hollowing out of the processus alveolaris of the maxilla (recessus alveolaris) ;

*b.* Excavation of the floor of the nasal fossa by a pushing of the recessus alveolaris between the plates of the palatum durum (recessus palatinus) ;

*c.* Extension of the sinus maxillaris into the processus frontalis of the maxilla (recessus infraorbitalis) ;

*d.* Hollowing out of the processus zygomaticus of the maxilla (recessus zygomaticus) ;

*e.* Extension to, and appropriation of an air cell within the processus orbitalis of the palate bone ;

To these should be added, according to my findings :

*f.* Extreme hollowing out of the body of the maxilla in all directions, thus causing the sinus walls to be thin and the recesses all markedly developed ;

*g.* The rarer condition when the lateral nasal wall is bulging towards the *cavum nasi*;

*h.* The extension of the recessus zygomaticus of the sinus maxillaris into the maxillary border of the zygomatic bone.

Zuckerkindl has found that the sinus may be made smaller, on the other hand, by:

*a.* Deficient absorption of the cancellated bone on the floor of the sinus;

*b.* Encroachment of the ventral wall of the cavity;

*c.* A deep fossa canina;

*d.* Thick sinus walls;

*e.* Excessive lateral bulging of the nasal wall;

*f.* A combination of the above conditions;

*g.* Imperfect dentition.

The thickness of the sinus walls varies from 5 to 8 mm. and down to that of a papery delicacy. The statement that all large cavities have thin walls and small cavities invariably thick walls does not hold in all cases. The smallest sinus measured in this series had the thinnest walls—of a papery delicacy. The smallness of this cavity was in part due to the marked simultaneous approximation of the ventral and medial walls.

The size of the sinus maxillaris is best determined by a series of measurements, viz.:

1. Dorsosuperior diagonal (D. S. D.)
2. Ventrosuperior diagonal (V. S. D.)
3. Superoinferior (S. I.)
4. Ventrodorsal (V. D.)
5. Mediolateral (M. L.)

These several measurements are determined thus (Fig. 24):

1. The dorsosuperior diagonal, from the most dorsal and lateral part of the sinus floor diagonally across the base or median wall of the sinus, to the most medial and superior part of the recessus infraorbitalis;

2. The ventrosuperior diagonal, from the most ventral and medial part of the recessus alveolaris diagonally across the base of the sinus, to the most lateral and superior point of the cavity;

3. The superoinferior, from the roof or infraorbital wall of the sinus, to the sinus floor (always using uniform points);



4. The ventrodorsal, from the most ventral point of the cavity midway between the roof and the floor, to the dorsal wall;

5. The mediolateral, from the base midway between its most ventral and dorsal points, to the processus zygomaticus of the maxilla (in some cases this extends into the maxillary border of the zygomatic bone, due to the extension of the recessus zygomaticus of the sinus maxillaris into this bone).

The ventrodorsal distance is especially affected by the degree of approximation of the ventral wall of the sinus; the superoinferior by the degree of hollowing out of the processus alveolaris of the maxilla; the mediolateral by the degree of encroachment of the lateral nasal wall; the ventrosuperior diagonal by the extent of the recessus alveolaris; and the dorsosuperior diagonal by the extent of the recessus infraorbitalis. Of course, there are other contributing factors to shorten or lengthen these distances, but these are the primary factors especially affecting the several measurements.

In order that the measurements of the sinus maxillaris may be of most value, it is necessary to compare the two sinuses of the same individual, to compare them with the respective sinuses of another individual; also to consider the age and the sex.

A careful examination of the following tables (A, B, C) will show conclusively that the sinus maxillaris has a rather wide range of variation. These tables also show that in the adult, age does not have much bearing on the size of the cavity. A reference to table C will show that the smallest cavity is that of an old man, aged 70 years; while the largest cavity is also that of an old man, aged 77 years. This same table shows that the cavity of a young adult, aged 21 years, is a close second to the largest sinus found in the whole series. Although the cavity in the male averages slightly larger than that of the female, a reference to table C will show that sex affects the size of the sinus but slightly.

The following may be given as average measurements of the adult sinus maxillaris, based on the measurements of 90 specimens:

	mm.
1 Dorsosuperior diagonal .....	38
2 Ventrosuperior diagonal.....	38.5
3 Superoinferior .....	33
4 Ventrodorsal .....	34
5 Mediolateral .....	23

Due to the great differences in the several measurements, the capacity of the sinus, in different individuals, must also differ. The range in capacity, of the sinuses studied to ascertain this fact, was from 9.5 cc. to 20 cc., with an average of 14.75 cc.

The tables A, B, and C show the range of measurements.

The conditions which produce these varied differences in the dimensions of the sinus maxillaris may be readily ascertained. Take for example the following two conditions which show a marked difference in the mediolateral plane, and yet the other measurements are inversed:

No.	V. D.	M. L.	S. I.	D. S. D.	V. S. D.
	mm.	mm.	mm.	mm.	mm.
1.....	30	18	40	41	41
2.....	35	35	35	40	30

In case No. 1 the lateral nasal wall was markedly bulging towards the sinus. In consequence of this encroachment, the mediolateral distance was greatly lessened. In case 2 the recessus alveolaris was poorly developed, hence the short ventrosuperior diagonal in comparison with the respective measurement in case No. 1. These cases show that even though a sinus may greatly exceed another in one of its measurements, it may be exceeded in size in its other planes.

Again there may be a great difference in the ventrodorsal distance. This means a marked inpushing of the ventral wall of the sinus, on the one hand, and a shallow fossa canina with a lessened encroachment on the other hand. Thus:

No.	V. D.	M. L.	S. I.	D. S. D.	V. S. D.
	mm.	mm.	mm.	mm.	mm.
1.....	25	15	25	35	36
2.....	43	20	30	41	37

If the body of the maxilla is hollowed out to a marked degree in all directions the measurements will be correspondingly lengthened. When this hollowing out has not been carried far, and when associated with some of the above mentioned conditions, the measurements will be markedly lessened. Thus:

No.	V. D.	M. L.	S. I.	D. S. D.	V. S. D.
	mm.	mm.	mm.	mm.	mm.
1.....	47	40	50	57	60
2.....	16	12	21	21	20

TABLE A.

Number	Sex	Age	Side	Ventro- Dorsal	Medio- Lateral	Supero- Inferior	Dorso- Superior Diagonal	Ventro- Superior Diagonal
1	M	54	( right	mm. 26	mm. 15	mm. 20	mm. 30	mm. 26
			( left	30	16	22	32	26
2	M	68	( right	40	22	50	50	50
			( left	35	24	35	45	50
3	M	36	( right	32	32	40	40	38
			( left	30	18	40	41	41
4	M	65	( right	30	15	30	33	30
			( left	25	15	25	35	36
5	M	55	( right	40	25	40	45	45
			( left	40	22	38	36	45
6	M	57	( right	40	21	32	50	38
			( left	32	25	30	32	43
7	M	71	( right	35	22	45	45	40
			( left	40	18	35	40	45
8	M	59	( right	40	22	33	45	45
			( left	40	35	40	50	45
9	M	79	( right	30	30	35	41	40
			( left	43	20	30	41	37
10	M	55	( right	31	24	30	30	38
			( left	32	25	35	40	40

TABLE B.

Number	Sex	Age	Side	Ventro-Dorsal	Medio-Lateral	Supero-Inferior	Dorso-Superior Diagonal	Ventro-Superior Diagonal
1	F	68	( right	mm. 35	mm. 35	mm. 35	mm. 40	mm. 30
			( left	40	16	30	43	36
2	F	52	( right	35	21	30	40	40
			( left	35	24	28	38	45
3	F	53	( right	40	25	30	60	42
			( left	33	30	45	45	46
4	F	47	( right	36	26	25	37	37
			( left	37	28	35	35	37
5	F	73	( right	33	24	31	38	40
			( left	37	24	37	30	42
6	F	50	( right	33	17	30	35	40
			( left	33	22	33	38	34
7	F	35	( right	30	18	32	30	35
			( left	30	21	30	30	40
8	F	39	( right	34	25	33	32	35
			( left	33	22	33	32	24
9	F	72	( right	38	25	38	32	34
			( left	35	23	38	33	35
10	F	52	( right	35	21	30	40	36
			( left	35	21	32	38	35



TABLE C.

Number	Sex	Age	Side	Ventro-Dorsal	Medio-Lateral	Supero-Inferior	Dorso-Superior Diagonal	Ventro-Superior Diagonal
				mm.	mm.	mm.	mm.	mm.
1	M	70	right	15	12	21	21	18
2	M	70	left	16	12	21	21	20
3	M	35	left	22	20	30	31	25
4	M	54	left	25	15	22	32	27
5	F	54	right	26	15	20	30	26
6	M	60	left	30	20	22	38	25
7	F	52	right	35	25	30	37	38
8	M	59	left	40	22	32	45	45
9	M	21	right	46	33	26	50	50
10	M	77	left	47	40	50	57	60

These few examples show how anatomic conditions will affect the measurements of the sinus maxillaris. It, therefore, appears reasonable that, by examination of the anterior surface of the maxilla and the lateral nasal wall, the size of the sinus may be approximately determined and the teeth relations judged. It does, however, not necessarily follow, because the ventral and median walls of the sinus are closely approximated, that the sinus capacity is markedly lessened. These sinuses may have marked infraorbital recesses and the processus alveolaris may be hollowed out towards its dorsal termination. In this manner compensation may be made for the marked bulging toward the cavity of the ventral and median walls of the sinus. It, however, remains that in the vast majority of cases, where these walls are simultaneously bulging into the cavity, the sinus is correspondingly reduced in size and the canine and premolar teeth not in direct relation to the sinus.

These variations in the approximation of the sinus walls, and the great difference in the extent of the various recesses, have a marked effect on the shape of the base of the cavity. A reference to figure 25 will show various shapes and sizes. Note especially case 4, in which the ventrosuperior diagonal is very short, and the dorsosuperior, because of a marked infraorbital recess, comparatively long. The great difference in the two diagonals produces a peculiarly shaped base.

## THE OSTIUM MAXILLARE.

When considering the embryology of the lateral nasal wall it will be remembered that the primitive maxillary pouch had certain relations of importance. These structures were the processus uncinatus, the infundibulum ethmoidale, the hiatus semilunaris, and the bulla ethmoidalis. The location of the ostium maxillare, of the adult, corresponds to the place of the primitive maxillary pouch. This pouch gradually develops into the pyramidal cavity of the adult, leaving the place of communication with the infundibulum ethmoidale at the point of primary evagination. It is, therefore, quite evident that these structures which in the embryo bore so close a relation to the Anlage of the sinus maxillaris, must now bear even more important relations to the ostium maxillare.

On raising or removing the middle nasal concha, in the adult, a rounded elevation—the bulla ethmoidalis, is seen. This structure is directed inferiorly and ventrally. Immediately beneath it is the well defined curved margin of the processus uncinatus of the ethmoid bone. Between these structures there is a narrow slit or semilunar cleft—the hiatus semilunaris, which is from 15 to 20 mm. long. This is an important opening, for it serves as the communication between the meatus nasi medius and the gutter-like groove (infundibulum ethmoidale) formed by these structures. The bulla ethmoidalis varies considerably in size. At times it is feebly developed and again it may assume comparatively large proportions. The size of the bulla greatly influences the width of the semilunar cleft or hiatus semilunaris. The bulla may be so large that its convexity comes in direct contact with the free margin of the processus uncinatus of the ethmoid bone. In other cases the hiatus semilunaris may be of considerable width.

It is easy to conclude what effect these conditions will have on the ostium maxillare directly, and on the sinus maxillaris indirectly. In one case the cleft of communication between the ostium maxillare and the meatus nasi medius is practically shut off, while in the other case a freer communication exists. It must be remembered that, even though the bulla touches the free margin of the processus uncinatus—thus greatly narrowing the hiatus semilunaris, the infundibulum ethmoidale may be of average dimensions. This is an important fact,

and must always be borne in mind when considering the frontomaxillary relations.

The processus uncinatus with its covering of mucous membrane projects inferiorly and dorsally. By its free superior border it forms the inferior boundary of the hiatus semilunaris. This process frequently terminates dorsally in what may be termed two roots; the inferior one passes towards the superior edge of the concha nasalis inferior, while the superior root curves superiorly behind the dorsal termination of the bulla ethmoidalis (Figs. 28 and 29). Such a condition, as the latter, causes the infundibulum ethmoidale to end dorsally in a pocket. This fact is of extreme importance, because the pocket is so situated that it will direct any fluid coming to the dorsal end of the infundibulum ethmoidale into the sinus maxillaris, via the ostium maxillare which is in the immediate location.

The infundibulum ethmoidale is a groove or gutter situated upon the lateral nasal wall. It is bounded superiorly by the inferior surface of the bulla ethmoidalis throughout the greater part of its extent, save ventrally and superiorly where the bulla is replaced by some anterior ethmoidal cells. The inferior and medial boundary of the groove is formed by the lateral surface of the processus uncinatus. This groove communicates with the meatus nasi medius through the hiatus semilunaris. The infundibulum may end, as stated above, in a pocket; or may lose its depth gradually and be lost in the meatus nasi medius (Figs. 28, 29, 30). The superior and ventral end of the infundibulum may terminate blindly without dilatation, or in an air cell; or may be continuous with the nasofrontal duct. The lateral wall of the infundibulum is formed partly by mucous membrane. The depth of this gutter-like channel, or the distance from the superior border of the processus uncinatus to the floor of the groove, varies from 1 to 12 mm., with approximately an average of 5 mm.

The sinus maxillaris communicates indirectly with the meatus nasi medius by means of an opening—the ostium maxillare—which pierces the superior and ventral part of the base of the cavity to open into the infundibulum ethmoidale, thence via the hiatus semilunaris into the meatus nasi medius. It must be clearly kept in mind that the ostium is located in the superior part of the sinus, and that it opens into the in-

fundibulum ethmoidale and not into the hiatus semilunaris, as many writers say. The ostium maxillare may be either in the most dependent part of the infundibulum or in the lateral wall of this channel. This opening varies in distance from the hiatus semilunaris from 1 to 12 mm. This distance is dependent upon the width of the processus uncinatus and the resultant depth of the infundibulum ethmoidale at this point.

The ostium may be round, but as a rule is either oval or elliptical. In my series of 90 cases it has a great range of dimensions; varying from 1 to 20 mm. in length, and from 1 to 6 mm. in width. In some cases where the ostium has reached considerable size it may almost entirely replace the lateral wall of the infundibulum ethmoidale, thus forming a long, slit-like communication between the sinus maxillaris and the infundibulum ethmoidale (Fig. 26) (Table D, Nos. 7 to 12).

The following table gives an idea of the range of dimensions of the ostium maxillare, as found in the series of specimens studied:

Number	TABLE D.	
	Length mm.	Width mm.
1.....	1	1
2.....	3	3
3.....	3	2
4.....	5	3
5.....	7	4
6.....	8	3
7.....	10	6
8.....	11	4
9.....	11	6
10.....	14	3
11.....	19	3
12.....	20	3

#### THE OSTIUM MAXILLARE ACCESSORIUM.

In many cases the sinus maxillaris has an accessory ostium communicating directly with the meatus nasi medius—the ostium maxillare accessorium. This opening is, as a rule, situated in the membranous portion of the lateral wall of the meatus nasi medius a short distance above the superior border



of the concha nasalis inferior, at. about the junction of its middle and posterior thirds. In some instances the accessory ostium is placed immediately behind the dorsal termination of the infundibulum ethmoidale (Fig. 27). This accessory ostium must not be confused with the duplication of the ostium maxillare, which communicates with the infundibulum ethmoidale.

According to Chiari and Hajek an accessory opening is found in every fifth case in the meatus nasi medius, posterior and inferior to the normal aperture. Giraldès says it is found in 10 per cent of cases, and represents a pathologic condition. Zuckerkandl and Kallius report it present in 10 per cent of cases. Turner found it four times in nine dissections.

That this accessory opening occurs more frequently than is generally supposed seems proven by the study of 80 adult specimens. Out of 80 specimens examined 35 showed accessory ostia, or a percentage of 43; while three cases had two accessory ostia, or a percentage of 3.75. From this it seems that the former figures were much too low. Whether this series had a special run for accessory ostia or whether too few specimens were used in the former reports is of course not known. It may, however, be said that the opening occurs very frequently and that the earlier reports, apparently, placed the percentage of occurrence far too low.

Just what the ostium maxillare accessorium means in all cases is indeed difficult to say. It seems almost incredible that so large a percentage of specimens should have pathologic openings. Giraldès bases his claim of a pathologic origin on the facts that the accessory ostium is absent in the young individual, and that the mucous membrane becomes thinned out in this locality—even though the opening fails to establish itself. Zuckerkandl corroborates the thinning of the mucous membrane in this locality at times, but claims that we have no evidence that it is always a pathologic process causing this condition. He says that occasionally the accessory opening is caused by neighboring structures:

“Seltenenfalls entsteht ein Ostium maxillare accessorium durch Druck von Seite nachbarlicher Organe; ich habe gesehen, das ein abnorm breiter zugespitzter Hakenfortsatz der Nasenscheidewand an der hinteren Nasenfontanelle eine Durchlocherung veranlasst hatte.”

I have not found the accessory ostium present in the fetus and infant. Unfortunately I have been unable to secure a sufficient number of specimens between the ages of 6 and 15 years to draw any conclusions of value on the occurrence of the ostium maxillare accessorium during this period of time. I found the accessory opening occasionally present in the young adult—17 to 20 years. The specimens (adult) studied ranged in age from 17 to 80 years, with the majority from subjects over 50 years old. That some cases of accessory ostia are of pathologic origin is doubtless true, but many cases certainly do not give any evidence of a pathologic process. The thinning of the mucous membrane, of which Giralès and Zuckerkandl speak, is very evident in many specimens. I, however, believe with Zuckerkandl that we must, in the majority of cases, look elsewhere than to a pathologic process for the determining factor in this condition.

In this connection it is important to note that out of the 35 sinus maxillares having accessory ostia, 27 of them had positive relations with the sinus frontalis, i. e., the infundibulum ethmoidale continuous with the nasofrontal duct. This would indicate that 77 per cent of sinus maxillares having positive frontomaxillary relations have accessory ostia communicating directly with the meatus nasi medius.

Another explanation for this accessory ostium may be found in the fact that since the sinus maxillaris develops by the growth of the sac and resorption of surrounding bone, its walls have a tendency to become thinned out most at points of least resistance. Such a point is found in the membranous portion of the base of the sinus, where bone is entirely wanting—the usual seat of the accessory opening. The mucous membrane in this position may become thinned out to such an extent, by the growth of the sinus, that an opening is formed; thus establishing the ostium maxillare accessorium.

Since the ostium maxillare opens into the infundibulum ethmoidale, and secondarily by way of the hiatus semilunaris into the meatus nasi medius, it is apparent that the ostium maxillare accessorium, with its more dependent location and direct communication with the meatus nasi medius, is more advantageously placed as a drainage opening for the sinus maxillaris. In some cases the ostium maxillare certainly seems inadequate—due to its position, relations and size—to

properly drain the sinus. Why then may we not say that this accessory ostium, in some cases, of necessity comes to be formed as a means by which the sinus maxillaris can more readily dispose of accumulated fluid? The process by which this is brought about need not necessarily be termed pathologic. Doubtless more information is necessary on this point before we dare draw conclusions.

Of course some specimens present accessory ostia which look decidedly pathologic; and as Zuckerkandl points out some are due to pressure caused by neighboring structures. I hope to study the subject more extensively in the embryo and child to see whether the opening, after all, at times, does not have an embryologic significance. Thus far I must agree with Giraldès that the ostium maxillare accessorium does not appear in the embryo and young child.

The accessory ostium varies much in size. In the series I studied the range of measurements was from 1 to 10 mm. long and from one-half to 10 mm. wide. The opening may be round or elliptical.

The appended table selected from a series of 80 specimens gives the range in size:

TABLE E.

Long mm.	Wide mm.
1	$\frac{1}{2}$
2	1
4	4
6	4
7	5
10	10

## THE FRONTOMAXILLARY RELATIONS.

It is interesting to note that Nathaniel Highmore (1651) recognized the fact that the sinus maxillaris at times receives fluid from other sources. In his brief description of the cavity (see previous paragraph) he makes brief mention of this important condition.

"Antrum hoc frequentius vacuum, aliquando muco repletum reperitur, in quod humores a capite per meatum quendam a cavitate illa in osse frontis, et ab osse ethmoeide distillare poterunt."



Although mentioning that fluid from the cavities in the frontal and ethmoid bones occasionally reaches the sinus maxillaris by way of the "meatum," he does not attempt to explain how this is brought about.

Tillaux ('40) found when injecting fluid into the sinus frontalis that some of it passed into the sinus maxillaris, instead of the whole amount passing into the meatus nasi medius. Cryer ('94, '01, '07), Fillibrown ('96, '97), reported on frontomaxillary relations. Lothrop's investigations ('98) show that in 47 per cent of cases the infundibulum ethmoidale is continuous with the nasofrontal duct, while 53 per cent show that the infundibulum ethmoidale has no connection with the sinus frontalis. Turner ('01) speaks briefly about the relation, and Wilson ('08) in his paper on the "Variations of the Ostium Frontale" alludes to this important relation. Some clinicians have reported isolated cases where they believed the maxillary trouble secondary to pre-existing frontal trouble, without, however, attempting to explain any anatomic conditions which would justify the clinical conclusions.

In order to secure the frontomaxillary relations in the specimens at hand, I undertook a series of investigations, including special dissections, filling the sinus frontalis with a fluid to determine the direction of drainage, and the determination of the efficiency of the infundibulum ethmoidale as a carrier of fluid.

It will be remembered that the infundibulum ethmoidale at its superior and ventral termination is either continuous with the nasofrontal duct, or ends blindly without dilatation, or in an air cell. The cases where it is continuous with the nasofrontal duct or with the sinus frontalis directly, represent what will be here spoken of as the positive frontomaxillary relations. Where the infundibulum ends blindly or in an air cell, the conditions will be spoken of as negative frontomaxillary relations.

According to the specimens I examined, the sinus frontalis may discharge fluid put into it in one of the following ways:

a. By the nasofrontal duct or the sinus frontalis being continuous with the infundibulum ethmoidale (in some cases there is no nasofrontal duct and the sinus frontalis is directly continuous with the infundibulum ethmoidale) (positive relation) (Fig. 28).



*b.* By the nasofrontal duct communicating directly with the meatus nasi medius (negative relation) (Fig. 29).

*c.* By a combination of the above conditions—in which case the sinus frontalis had two nasofrontal ducts; one continuous with the infundibulum ethmoidale, and the other communicating directly with the meatus nasi medius (positive and negative relations) (Fig. 30).

*d.* By the nasofrontal duct being continued down to the infundibulum ethmoidale at an angle; and in conjunction there being a passageway between the ventral attachment of the concha nasalis media and the processus uncinatus of the ethmoid bone, to the meatus nasi medius (considered as positive relations).

*e.* By a direct communication between the sinus maxillaris and the sinus frontalis, by what may be termed the maxillo-frontal duct (direct relation) (Fig. 26).

Of the 80 specimens studied to ascertain the frontomaxillary relations, 45 showed a positive relation, or a percentage of 56.25; 32 a negative relation, or a percentage of 40; 2 a combination of positive and negative, or a percentage of 2.5; 1 a direct communication between the two sinuses, or a percentage of 1.25.

The importance of the above conditions was in each case tested by putting fluid into the sinus frontalis to determine the course of drainage. It at once became apparent that the specimens falling under classes (*a*) and (*d*) should be classed together as representing positive frontomaxillary relations. The only difference in the above two conditions is that in class (*a*) all of the fluid put into the sinus frontalis will reach the superior and ventral part of the infundibulum ethmoidale; while in class (*d*) some of it will pass directly into the meatus nasi medius, and the remaining portion to the infundibulum ethmoidale.

Class (*b*) will drain fluid from the sinus frontalis directly into the meatus nasi medius. It is, however, important to know that even in these cases some fluid may reach the infundibulum ethmoidale, because of the intimate relations existing between the nasofrontal duct and the superior and ventral end of the infundibulum ethmoidale (Fig. 29).

Class (*c*), where the sinus frontalis has two nasofrontal ducts, the drainage is of course partly into the meatus nasi

medius and partly into the infundibulum ethmoidale. This class leads to similar results as mentioned above, the only difference being that the infundibulum does not receive as much fluid in a given time.

Class (*c*) fortunately represents a rare condition. Here the sinus frontalis drains directly into the sinus maxillaris. In the specimen I found with this direct relation there was also a communication between the infundibulum ethmoidale and the sinus frontalis. Cryer, Bryan, and Brophy have reported direct relations between the two sinuses, which I have been able to verify in this one specimen. In cases where the lateral wall of the infundibulum ethmoidale is largely wanting, fluid from the frontal sinus (providing the infundibulum ethmoidale is continuous with the nasofrontal duct) will pass almost directly into the sinus maxillaris, and will, therefore, very closely simulate a direct communication between the two sinuses. A probe passed from the sinus frontalis will, in such cases, also pass into the sinus maxillaris. Doubtless some of these cases have been considered by some clinicians as direct communications, whereas a further dissection would have proved them otherwise (Fig. 26).

The question now arises—what happens to the fluid that has reached the superior and ventral end of the infundibulum ethmoidale? In the first place it may be said that the efficiency of the infundibulum ethmoidale, as a carrier of fluid, is in direct ratio to its depth and to the degree of overhanging of the mucous membrane from the free border of the processus uncinatus of the ethmoid bone. In some cases the processus uncinatus is so narrow that the infundibulum ethmoidale has no appreciable depth at its superior end, and in these cases the fluid which has reached it from the frontal region will soon leave the shallow groove after entering it—at least a goodly portion of it. In other cases the processus uncinatus is broad, and the resultant infundibulum ethmoidale deep and channel-like. It must also be recalled that in a previous paragraph mention was made of the fact that frequently the infundibulum ethmoidale ends dorsally in a pocket, so situated that it will direct the flow of fluid coming to the dorsal end of the infundibulum ethmoidale into the ostium maxillare—thence into the sinus maxillaris (the ostium maxillare being patent) (Figs. 28, 29).

We have, therefore, a gutter-like channel, of varying depth and efficiency, communicating between the frontal region and the sinus maxillaris; including the sinus frontalis in 56 per cent of cases and some of the cellulæ ethmoidales anterior in nearly all cases.

In the cases where the infundibulum ethmoidale does not end in a pocket dorsally (Fig. 30), much of the fluid that would otherwise be directed into the sinus maxillaris by this pocket, passes from the dorsal termination of the infundibulum ethmoidale into the meatus nasi medius. This, however, makes little difference—the very fact that some of the fluid gets into the sinus maxillaris makes the condition similar to the above. It requires merely more time to accomplish the same end result—a filled sinus maxillaris.

In case the ostium maxillare is not patent, the fluid after reaching the dorsal end of the infundibulum ethmoidale rises in the channel and finally passes through the hiatus semilunaris into the meatus nasi medius.

That the sinus maxillaris, because of its position and relations, is a reservoir for some or all of the fluid coming to the dorsal end of the infundibulum ethmoidale, is a fact that admits of no debate (the ostium maxillare being patent).

#### IMPORTANT NERVE RELATIONS OF THE SINUS MAXILLARIS.

The roof or orbital wall of the sinus maxillaris is traversed by the infraorbital sulcus and the infraorbital canal. These passageways transmit the infraorbital vessels and nerve (considering the maxillary nerve as the infraorbital nerve from the proximal end of the infraorbital sulcus on). As a rule, the canal has comparatively thick walls, but in many cases the inferior wall of the canal is of a papery delicacy and is easily compressed against the contained nerve and vessels. Frequently the canal is replaced by a groove, with the opening of the groove directed towards the sinus maxillaris. The structures—infraorbital nerve and vessels—contained in the groove are merely covered with the mucous membrane of the sinus.

The posterior superior alveolar (dental) nerves, branches of the maxillary nerve, in most of my cases were found to pass inferiorly and ventrally upon the infratemporal surface of the maxilla, through the alveolar foramina into the alveolar canals. They thus aided in the formation of the superior



dental plexus of nerves. Occasionally some of the branches of these nerves, instead of taking the above course, passed entirely through the infratemporal surface of the maxilla into the sinus maxillaris. They then passed under cover of the mucous membrane of the sinus inferiorly and ventrally to the sinus floor; thence to the superior dental plexus.

The middle superior alveolar (dental) nerve, a branch of the infraorbital nerve, was as a rule given off in the proximal part of the infraorbital canal. It passed inferiorly and ventrally in a canal in the lateral wall of the sinus maxillaris and aided in establishing the superior dental plexus of nerves. The nerve I found in one case to arise from one of the anterior superior alveolar nerves. It also rarely passed under cover of the mucous membrane of the sinus to the superior dental plexus.

The anterior superior alveolar (dental) nerve was given off from the infraorbital nerve, proximal to the infraorbital foramen. It passed inferiorly in the alveolar canal of the anterior surface of the maxilla and took part in forming the superior dental plexus of nerves. From this plexus arose the superior dental nerves which supply the fangs of the teeth, the gums, and give numerous branches to the maxilla and the mucous membrane of the sinus maxillaris.

I also observed—a very important condition—that in one case the anterior superior alveolar nerve came off from the infraorbital nerve quite a distance proximal to the infraorbital foramen. The nerve then passed through the inferior wall of the infraorbital canal and took a course diagonally across the sinus from the roof to its ventral wall. The nerve thus suspended freely in the cavity of the sinus maxillaris was surrounded merely with mucous membrane (Fig. 31).

#### CONCLUSIONS.

1. The Anlage of the sinus maxillaris appears during the third month of fetal life as a minute epithelial sac evaginating and growing at first inferiorly, later more laterally, from the dorsal end of the primitive infundibulum ethmoidale.
2. The primitive maxillary pouch may be duplicated. In some cases this may account for the duplication of the ostium maxillare of the adult sinus, i. e., the two pouches fusing distally, leaving the two points of evagination as the adult



ostia. Other duplications of the ostium may develop in a way similar to that of the accessory ostium.

3. The primitive ostium maxillare varies very much in its dimensions in different embryos. This is entirely in accord with adult conditions, since the ostium of the adult sinus has a great range of dimensions.

4. Dentition seems to influence the size of the cavity but little. The age of the child and the size of the sinus apparently progress *pari passu*.

5. The cavity enlarges by the simultaneous growth of the sac and the resorption of surrounding tissue. These two processes taking place *pari passu* with the growth of the face.

6. In a fetus at term the ventrodorsal measurement of the sinus is about 7 mm., and in a child aged 20 months it is about 20 mm. The cavity reaches its full size from the fourteenth to the eighteenth year.

7. The following may be given as average measurements of the adult sinus maxillaris, based on the measurements of 90 adult specimens:

	mm.
1 Dorsosuperior diagonal.....	38
2 Ventrosuperior diagonal .....	38.5
3 Superoinferior .....	33
4 Ventrodorsal .....	34
5 Mediolateral .....	23

8. The range in capacity of the sinuses studied to ascertain this fact was from 9.5 cc. to 20 cc., with an average of 14.75 cc.

9. In the majority of cases the sinus floor is at an inferior level to the nasal floor. This distance varies from one-half to 10 mm. Sex has little influence on this relation.

10. The number of teeth that bear a direct relation to the sinus is inconstant, due to the great difference in the size of the cavity in different individuals. The three most constant teeth in direct relation are the three molars.

11. The tooth fangs may cause the formation of elevations on the sinus floor. Occasionally the fangs of some teeth are in direct communication with the mucous membrane of the cavity.

12. Frequently the walls of the sinus are uneven, due to ridges, or crescentic projections. These prominences form

pockets and recesses within the cavity. Occasionally the cavity is divided by a septum into two distinctly separate compartments, each having an independent opening into the nasal fossa, but not communicating with each other.

13. The adult sinus varies much in size in different individuals, and the asymmetry on the two sides of the same individual is often marked.

14. Age, sex, and side (right or left) influence the size of the adult sinus but little.

15. The adult ostium maxillare varies much in size. It is located in the superior and ventral part of the base of the cavity, and serves as a means of communication between the sinus maxillaris and the infundibulum ethmoidale. Occasionally it replaces the greater portion of the lateral wall of the infundibulum ethmoidale, and represents a slit-like aperture. The ostium may be duplicated.

16. The ostium maxillare accessorium is of very frequent occurrence. It serves as a means of direct communication between the sinus maxillaris and the meatus nasi medius. In my series of specimens it was present in 43 per cent of cases. The aperture was not found in the fetus and infant.

17. Most of the accessory ostia do not look pathologic, and the writer believes that we must, in many cases, look elsewhere than to a pathologic process for the determining factor in this condition.

18. Of the specimens studied to ascertain the frontomaxillary relations, 56 per cent showed that the infundibulum ethmoidale was intimately related with the nasofrontal duct or with the sinus frontalis directly—in case the nasofrontal duct was wanting; 40 per cent showed that the nasofrontal duct communicated directly with the meatus nasi medius—the infundibulum ethmoidale ending blindly or in an air cell; 2.5 per cent showed two nasofrontal ducts, one continuous with the infundibulum ethmoidale, and the other communicating with the meatus nasi medius; 1.25 per cent showed a direct communication between the sinus frontalis and maxillaris.

19. Since the infundibulum ethmoidale receives the ostium maxillare at its dorsal and inferior end in all cases, and the nasofrontal duct, or the sinus frontalis directly, at its ventral and superior end in over one-half the cases, it very frequently serves as a gutter-like channel, of varying depth and

efficiency, communicating between the frontal region and the sinus maxillaris.

20. The sinus maxillaris, therefore, acts as a reservoir for fluids coming to the dorsal end of the infundibulum ethmoidale (the ostium maxillare being patent).

21. Frequently the processus uncinatus by a superior curving at its dorsal end causes the infundibulum ethmoidale to end in a pocket. This pocket is so situated that it directs fluids coming to the dorsal end of the infundibulum ethmoidale into the sinus maxillaris—via the ostium maxillare which is in the immediate vicinity.

22. Occasionally branches of the superior alveolar nerves in passing to the superior dental plexus pass entirely through the walls of the sinus, thence under cover of the mucous membrane of the cavity to their destination. Rarely the anterior superior alveolar ramus, instead of taking its usual course, passes diagonally from the roof of the sinus to its ventral wall—the nerve thus suspended freely in the cavity is merely covered with the mucous membrane.

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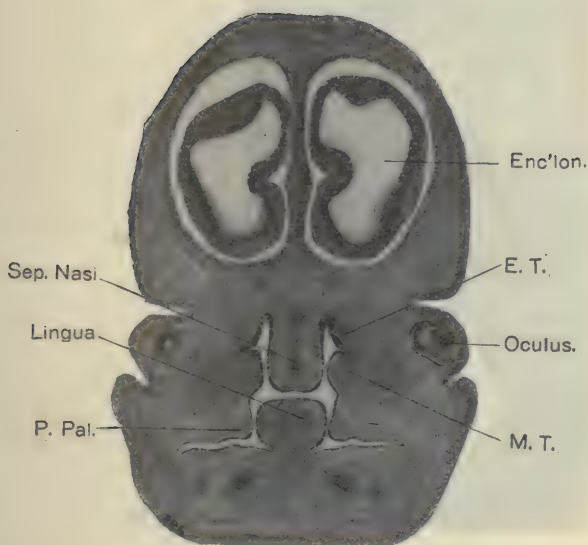


Figure 1 ( $\times 10$ ). Drawing of a frontal section through the head of an embryo aged about 45 days, in the region immediately dorsal to the organon vomeronasale (Jacobsoni), note the development of the early turbinal processes, and that there is no cartilage laid down in them at this early period. This is contradictory to the theory that the turbinal processes are primarily the result of an inpushing of the lateral nasal wall by cartilaginous strands which later become the nasal conchae.

Enc'lon, = encephalon; E. T., = ethmo-turbinalia; M. T., maxillo-turbinal; P. Pal., = processus palatinus; Sep. Nasi, = septum nasi.





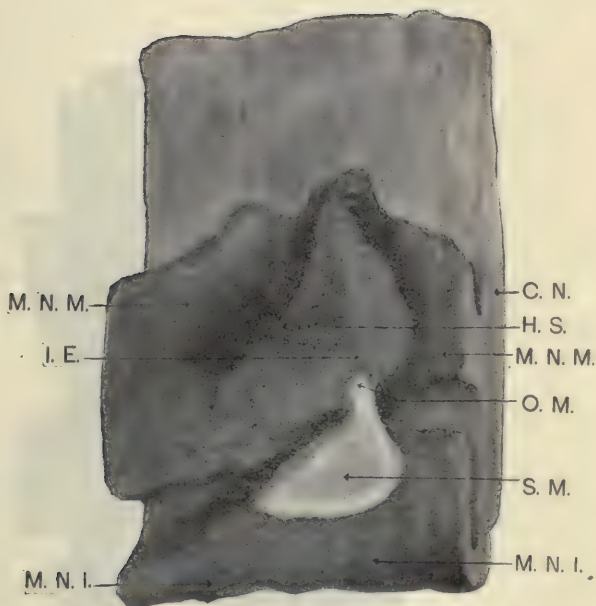


Figure 2 ( $\times 10$ ). Drawing of a reconstruction of portion of the right nasal cavity, including the meatus, infundibulum ethmoidale, and the sinus maxillaris. Only that portion of the nasal cavity necessary to include the sinus maxillaris and its relations is shown.

Compare the size of the ostium maxillare with the corresponding aperture in Figure 3.

The model was reconstructed from the nose of an embryo aged 105 days. It must be remembered that the drawing represents cavity, and is, therefore, a negative.

M. N. M., M. N. I., = meatus nasi, medius et inferior; J. E., = infundibulum ethmoidale; C. N., = cavum nasi; H. S., = hiatus semilunaris; O. M., = ostium maxillare; S. M., = sinus maxillaris.





Figure 3 ( $\times 10$ ). Drawing of a reconstruction of portion of the right nasal cavity of an embryo aged 120 days. The drawing includes the meatus, infundibulum ethmoidale, and the sinus maxillaris. Only that portion of the cavity was modeled so as to include the sinus maxillaris and its relations. Since it represents cavity it is a negative.

Note the very extensive ostium maxillare in comparison to that in figure 2.

M. N. S., = meatus nasi superior; M. N. M., M. N. I., = meatus nasi, medius et inferior; I. E., = infundibulum ethmoidale; C. N., = cavum nasi; H. S., = hiatus semilunaris; O. M., = ostium maxillare; S. M., = sinus maxillaris.





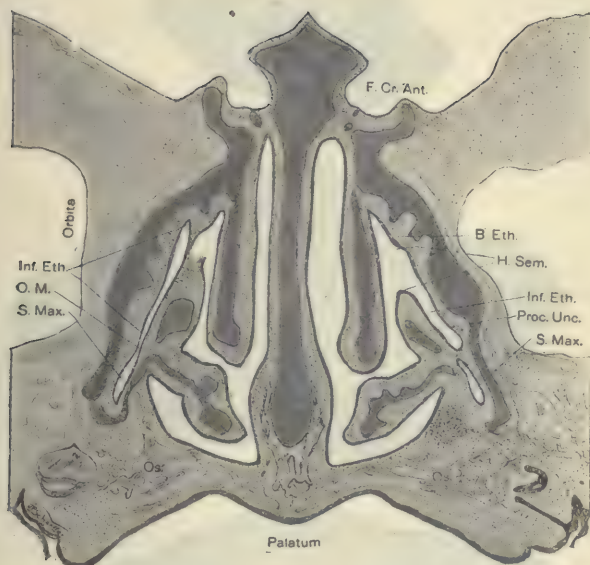


Figure 4 ( $\times 6.6$ ). Drawing of a frontal section of the nose of an embryo aged 120 days. The section is 7.25 mm. from the tip of the nose. Note that on one side the section is in the region of the ostium maxillare, on the other it is dorsal to it; also the fusion between the processus uncinatus and a frontal concha.

Inf. Eth., = infundibulum ethmoidale; O. M., = ostium maxillare; S. Max., = sinus maxillaris; Os., = developing bone; F. Cr. Ant., = fossa cranii anterior; B. Eth., = bulla ethmoidalis; H. Sem., = hiatus semilunaris; Proc. Unc., = processus uncinatus.





Figure 5 ( $\times 4$ ). Drawings of the mucous membrane, representing the exact shapes of the sinus maxillaris at different stages of its development in the fetus and child.

A. From a fetus aged 4 months. B. From a fetus at term. C. From a child aged 18 to 20 months. D. From a child aged 20 to 23 months.





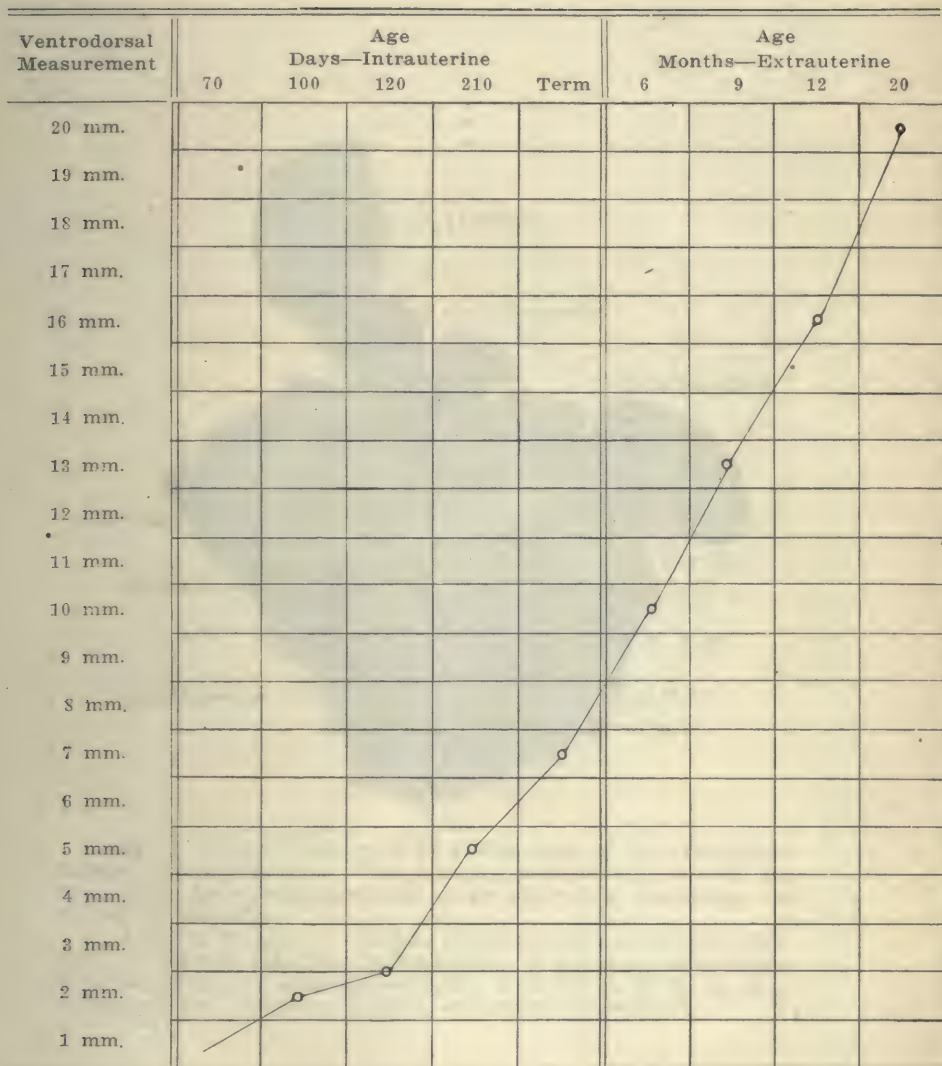


Figure 6. Chart showing the gradual increase in size of the sinus maxillaris in its ventrodorsal plane.





Figure 7 (0.9). Photograph of a dissection of the sinus paranasales of the left side. The mucous membrane is shown, the bony walls have been dissected away after first hardening the subject in formalin.

C. N. M., C. N. Inf., = conchae nasales, media et inferior; Sep. Nasi, = septum nasi; Cc. Ethmoidales, = cellulae ethmoidales; S. Sphenoidalis, = sinus sphenoidalis; M. N. S., M. N. M., M. N. I., = meatus nasi, superior, medius, et inferior, respectively.





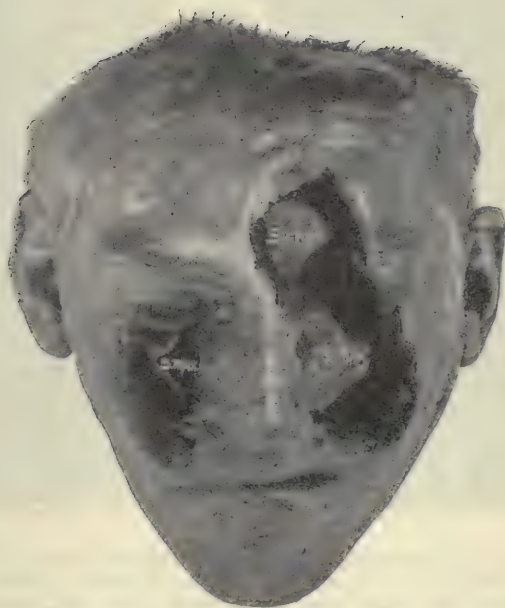


Figure 8 ( $\times .385$ ). - Photograph of a dissection of the sinus maxillaris and frontalis from a ventral view.

S. Fron., S. Max., = sinus frontalis et maxillaris, respectively.



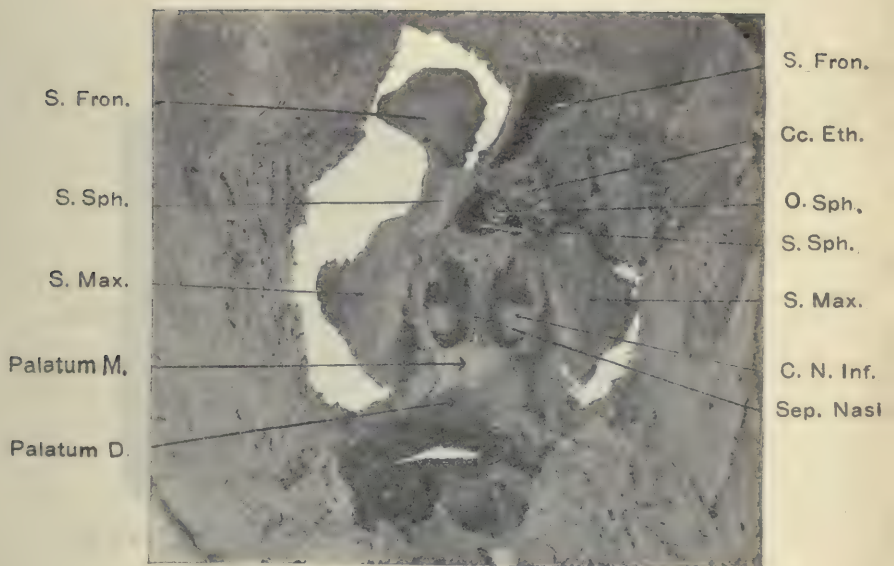


Figure 9 ( $\times .64$ ). Photograph of a dissection of the sinus paranasales from a dorsal view. The mucous membrane of the cavities is shown, the bony walls have been dissected away. The sinus frontalis and sphenoidalis, and the cellulae ethmoidales of the right side have been opened.

S. Fron., S. Sph., S. Max., = sinus frontalis, sphenoidalis, and maxillaris, respectively; Palatum M., Palatum D., = palatum molle and palatum durum, respectively; Cc. Eth., = cellulae ethmoidales; O. Sph., = ostium sphenoidale; C. N. Inf., = concha nasalis inferior; Sep. Nasi, = septum nasi.





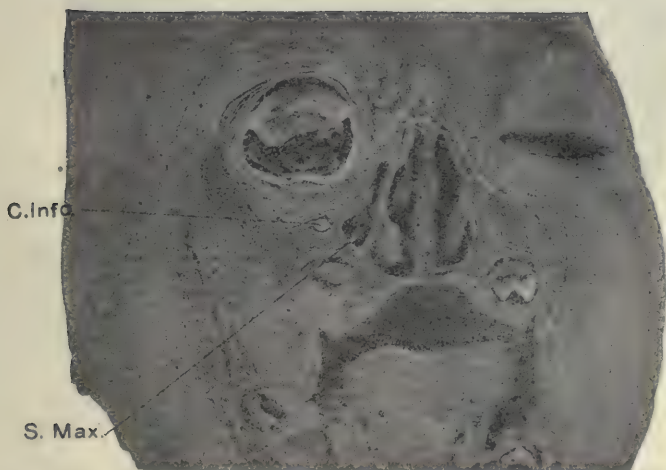


Figure 10 ( $\times .8$ ). Photograph of a frontal section of a child's face aged from 16 to 18 months. Note the infraorbital canal and nerve, and the relation of the sinus maxillaris to the developing teeth. It will be noticed that the sinus maxillaris has developed sufficiently to reach beneath the orbit, but that it is medial to the infraorbital canal.

C. Info., = canalis infraorbitalis; S. Max., = sinus maxillaris.



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Figure 11 ( $\times .8$ ). Photograph of a frontal section of an adult's face in the region of the sinus maxillaris. Note the location of the ostium maxillare and the infundibulum ethmoidale. Although the section is not exactly a frontal one, there is nevertheless a marked asymmetry in the size of the two sinus maxillares. There is also quite a difference in the relation of the sinus floor to the nasal floor on the two sides.

S. Max., = sinus maxillaris; B. Eth., = bulla ethmoidalis; H. Sem., = hiatus semilunaris; Proc. Unc., = processus uncinatus; C. Info., = canalis infraorbitalis; Inf. Eth., = infundibulum ethmoidale; O. M., = ostium maxillare.

Figures 12 to 17. Photographs of dissections showing variations in the teeth relations of the sinus maxillaris.

Figures 12, 13 ( $\times .48$ ). Note the short ventrosuperior diagonal of the sinus maxillaris, due to the simultaneous approximation of the ventral wall and the base of the sinus. As a result, the only teeth in direct relation to the cavity are the second and third molars.

Figure 14 ( $\times .456$ ). Note that the premolar teeth are not in direct relation, and that the canine tooth, as in the preceding figures, would certainly be a bad tooth to use in attempting to drain the cavity through the canine socket.

Figure 15 ( $\times .48$ ). This figure shows to what extreme the body of the maxilla may be hollowed out by the sinus maxillaris. Note the very delicate walls of the cavity, especially the shell-like alveolar process. Due to the extensive recessus alveolaris the "remaining tooth" projects into the lumen of the cavity and is merely covered with the mucous membrane of the sinus.

Figure 16 ( $\times .552$ ). Although the processus alveolaris is comparatively thick, the second-molar tooth fangs just reach the mucous membrane of the cavity. Note the large ostium maxillare accessorium.

Figure 17 ( $\times 1.28$ ). Showing the relations of the developing teeth to the sinus maxillaris, of a child aged from 18 to 20 months. Note the position of the Anlagen of the permanent teeth.

S. Max., = sinus maxillaris; C. P., = crescentic projection; D. p. r., = dentes permanentes rudimentii; Sep. Nasi, = septum nasi; F. Info., = foramen infraorbitale; D. d., = dentes decidui.



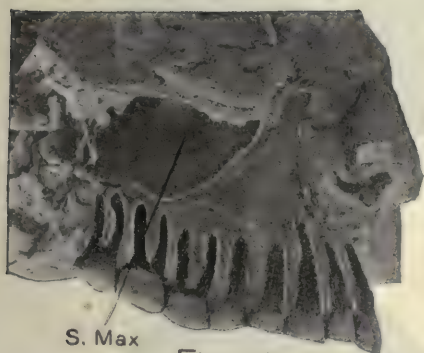


Fig. 12

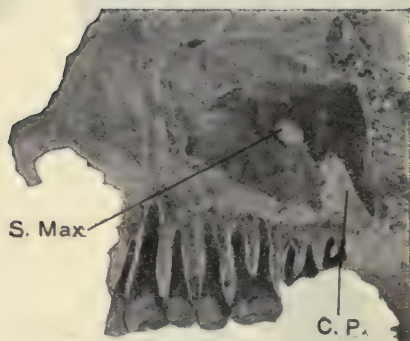


Fig. 13

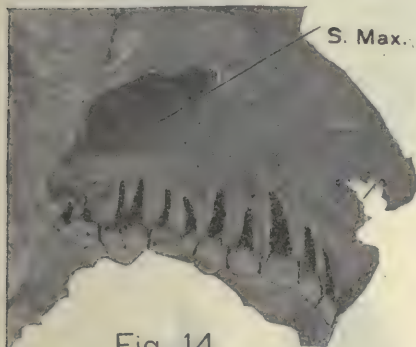


Fig. 14

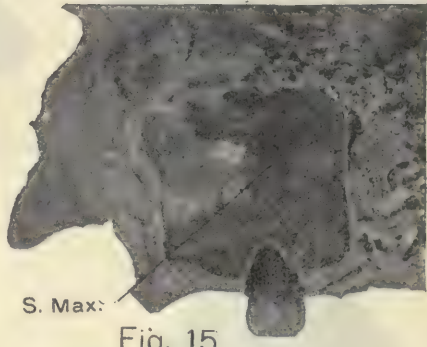


Fig. 15

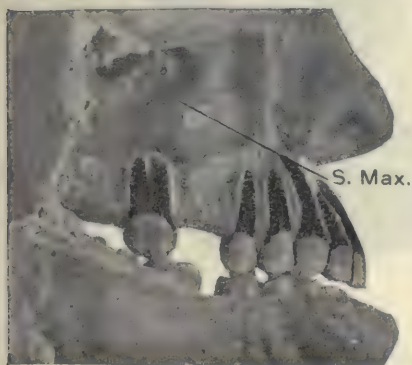


Fig. 16

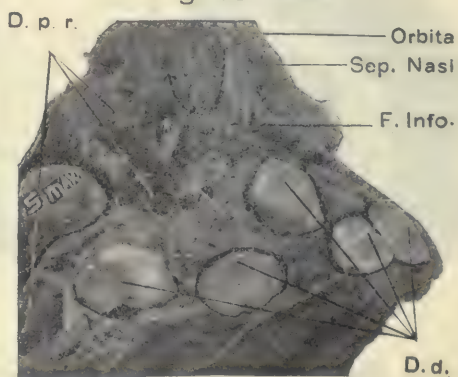


Fig. 17





Fig. 18

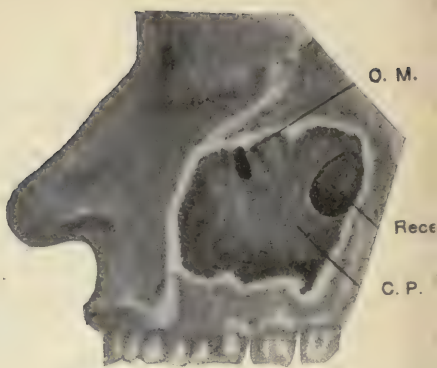


Fig. 19



Fig. 20

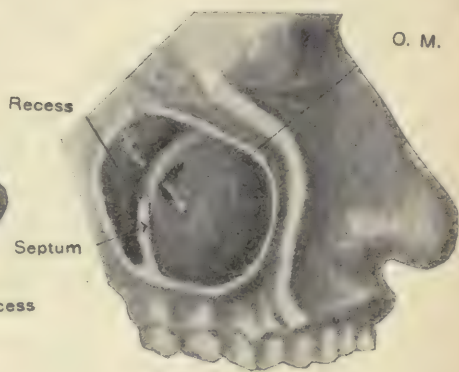


Fig. 21



Fig. 22

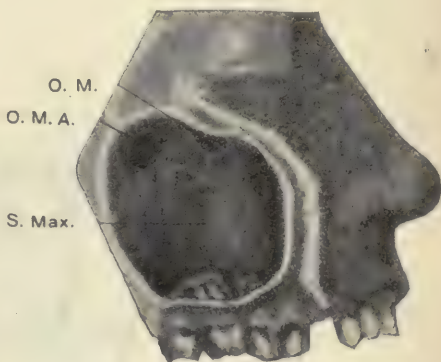


Fig. 23

Figures 18 to 23 Drawings of specimens showing septa and crescentic projections on the walls of the sinus maxillaris. Note how these projections form recesses within the cavity. (Figure 22 is modified from E. Zuckerkandl, Normale und pathologische Anatomie der Nasenhöhle und ihrer pneumatischen (Anhaenge).  
C. P., = crescentic projection; O. M., = ostium maxillare; O. M. A., = ostium maxillare accessorium; S. Max., = sinus maxillaris.







Figure 24.

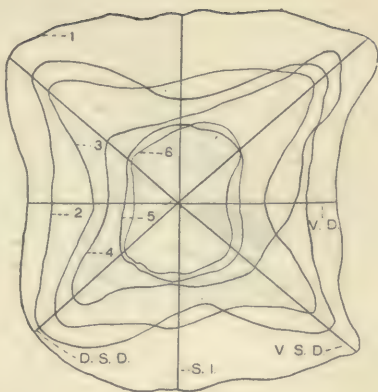


Figure 25.

Figure 24. Schematic drawing of the right maxilla. The ventrolateral wall of the sinus maxillaris has been removed, thus exposing the base or median wall of the cavity. The lines drawn on the base indicate the position of the several measurements.

1, Dorsosuperior diagonal; 2, Ventrosuperior diagonal; 3, Superoinferior; 4, Ventrodorsal; 5, Mediolateral.

Figure 25 ( $\times 1$ ). Composite chart showing how anatomic variations in the extent of the recesses and the approximation of the walls of the sinus maxillaris affect the shape and size of its median wall or base.

1 to 6, = outlines of different bases; V. D., S. I., V. S. D., D. S. D., = ventrodorsal, superoinferior, ventrosuperior diagonal, and dorsosuperior diagonal, respectively.

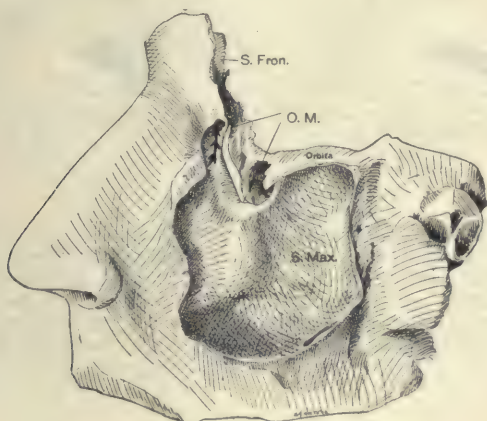


Figure 26.

Figure 26 ( $\times .66$ ). Drawing of a specimen showing a direct communication between the sinus frontalis and maxillaris (indicated by the arrow).

Note the very large slit-like ostium maxillare. The lateral wall of the infundibulum ethmoidale is entirely wanting.

S. Fron., = sinus frontalis; S. Max., = sinus maxillaris; O. M., = ostium maxillare.





Figure 27. Diagrams of the lateral nasal wall. The conchae nasales mediae have been partially cut away so as to bring to view the underlying structures. Note the positions and varying sizes of the ostium maxillare accessorium in the different diagrams. The accessory ostia are designated by the deep black circles. The upper and lower right hand diagrams show two accessory ostia and the others but one.





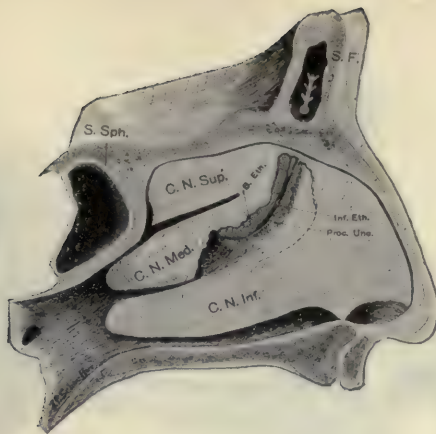


Figure 28. A semidiagrammatic drawing of the lateral nasal wall showing positive frontomaxillary relations. Note that the infundibulum ethmoidale is directly continuous with the naso-frontal duct. Note also the superior and lateral curving of the processus uncinatus at its dorsal termination, thus forming a pocket at the dorsal end of the infundibulum ethmoidale. This pocket is so situated that it will direct fluid coming to the dorsal end of the infundibulum ethmoidale to the ostium maxillare and into the sinus maxillaris.

The concha nasalis media is in part cut away so as to expose the underlying structures.



Figure 29. A semidiagrammatic drawing of the lateral nasal wall of the concha nasalis media partially removed. Note that the infundibulum ethmoidale terminates blindly at its superior and ventral end. The nasofrontal duct communicates directly with the meatus nasi medius and not with the infundibulum ethmoidale as in the preceding figure (28). This represents negative frontomaxillary relations.

C. N. Sup., C. N. Med., C. N. Inf., = conchae nasales, superior, media and inferior; S. Sph., = sinus sphenoidalis; S. F., = sinus frontalis; B. Eth., = bullae ethmoidales; Inf. Eth., = infundibulum ethmoidale; Proc. Unc., = processus uncinatus.



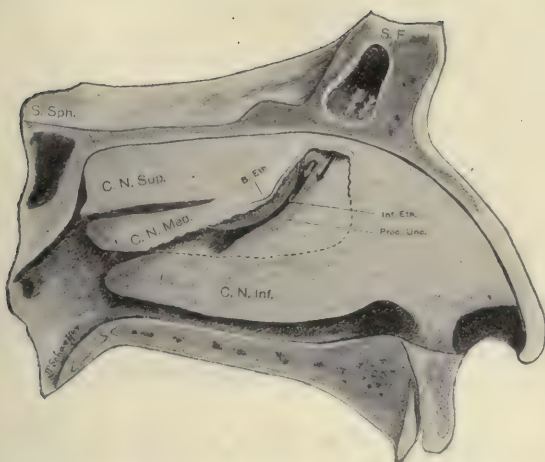


Figure 30. A semidiagrammatic drawing of the lateral nasal wall showing that the sinus frontalis, in this case, has two naso-frontal ducts, one communicating with the infundibulum ethmoidale and the other with the meatus nasi medius.

Note that the infundibulum ethmoidale terminates at its dorsal extremity in the meatus nasi medius without a pocket formation (compare this condition with figs. 28, 29).

C. N. Sup., C. N. Med., C. N. Inf., = conchae nasales, superior, media and inferior; S. Sph., = sinus sphenoidalis; S. F., = sinus frontalis; B. Eth., = bulla ethmoidalis; Inf. Eth., = infundibulum ethmoidale; Proc. Unc., = processus uncinatus.

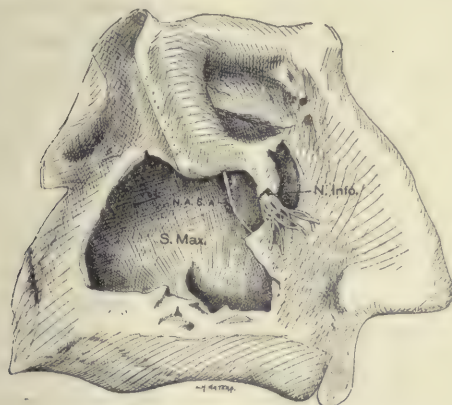


Figure 31 ( $\times .633$ ). Drawing from a dissection showing the anterior superior alveolar nerve (N. A. S. A.) passing diagonally from the roof or orbital wall of the sinus to the ventral or facial wall. The nerve in this position is suspended freely in the cavity of the sinus maxillaris merely covered with mucous membrane.

N. A. S. A., = nervus alveolaris superior anterior; N. Info., = nervus infraorbitalis; S. Max., = sinus maxillaris.





THE EFFECT OF MAXILLARY READJUSTMENT  
UPON THE DEVELOPMENT OF NASAL  
CHAMBERS AND FACE.

BY GEO. V. I. BROWN, A. B., D. D. S., M. D., C. M.,

MILWAUKEE.

So much has been written during recent years, more especially perhaps in the last year or two, of the close relation existing between oral and nasal deformities, resulting in more active co-operation between rhinologists, oral surgeons, orthodontists and dentists, these in turn being brought more frequently into consultation with the general practitioner, that I feel it to be quite unnecessary to submit proof of the generally accepted fact that contracted dental arches and high arched palatal vaults are often associated with deviated nasal septa, contracted nares and other nasal defects and that these are commonly found together in individuals who have adenoids and enlarged tonsils. The effect of any one or all of these conditions upon health and development, both local and general, as well as upon nervous conditions and pathologic alteration of the tissues directly affected, may also be taken for granted as being so fully and generally understood as to preclude the necessity of elaboration. Our subject, stripped of these divisions, presents for consideration at this time the following features which demand attention. First: Can direct improvement of intra-nasal conditions be effected by treatment of dental and maxillary conditions? Second: How may this best be accomplished?

The consideration of these two questions, elementary as

they are, requires at least a cursory study of developmental principles from the very beginning of embryonic life, and of both prenatal and postnatal factors in development of the parts directly under consideration and the organism as a whole.

In the short period between the fertilization of the human ovum and the fifth to the seventh week of embryonic life we find upon examination of the sections through fetal heads that important changes have already taken place, which even at this early date are indicative of the principles that must govern our treatment in correction of deformities during the entire period of development of the individual.

It is important to note (see Fig. 1) that complete coalescence of the divisions of the forming face and the mouth, resulting from progress in this direction of the several centers from which development of the head of the embryo takes place, has not yet been completed. If, therefore, between approximately the fifth and ninth week of embryonic life, arrest of development takes place, there will be failure to unite in this particular region, the result of which will be harelip, cleft palate or both in any of the various forms in which these mal-developments appear. Re-establishment of growth in its natural course may and usually does result in correct form of other divisions of the head and face, except in so far as they may be influenced by the effect of the disarrangement of muscular and other physiologic action through the deformity which has now become established.

Inspection of a section through the jaws at this period, under higher magnification, shows the epithelial cord which marks the appearance of the first indication of the tooth germs.

Passing in succession through a series of similar sections (Figs. 2—3) at important periods until birth, we find that in the absence of arrest or other interference with normal growth the divisions of the palate become completely united, and the spaces for the nares so much enlarged that with those of the maxillary sinuses, they occupy a very considerable portion of the facial division. The palatal surface at this time is flat, because development of the alveolar regions has not yet taken place to any considerable extent.

As the tooth follicles increase in size and their eruption thus becomes more completely established, some of them are situated high up and just outside the nares. If growth of the alveolar ridges takes place in natural form unimpeded by any factor which may tend to restrict the natural size of the arch, the developing tooth crowns, the germs for both temporary and permanent sets of which are in place before birth, can pass on downward and outward in the natural course of their eruption, thus making it possible for the nares and their dividing septum, as well as turbinal and other nasal structures, to assume in due course normal form and proportions. If, however, from any cause, whether it be surgical, mechanical, developmental or pathologic, there is interference with the natural expansion of the arch, which represents the alveolar ridge and later the dental arch, it naturally follows that there must be crowding through want of space for the tooth crowns to assume their rightful positions in relation to others that are being pushed onward by forces through the action of which tooth eruption takes place. The first effect of pressure from crowding must naturally react upon regions of the maxillæ in which the tooth crowns at this time are located. Effort at readjustment naturally takes place in the direction of least resistance. This must be in the direction of the nares, and causes in greater or less degree abnormality of form, chiefly evident in their restricted size.

The second effect is overlapping of the tooth crowns, evidenced by their eruption on the outside or the inside of the true line of the arch, resulting in labial, buccal or lingual occlusion. When the process of eruption has continued to a point where the cusps of the teeth in the occluding jaws can come in contact with each other, the muscular forces of jaw movement, acting upon the inclined planes of the cusps and the crown surfaces of the teeth, bring into play the active factors through which regular or irregular forms of dental arches are determined.

Glancing for a moment upon the obverse side of this developmental picture, we must recognize the fact, that from the moment of the very first respiration at birth, one of the most

potent influences upon which this jaw expansion and development depend is the physiologic action of correct respiration; thus we have established backward and forward an interrelation of growth so evenly balanced that it would naturally seem to preclude its being unusually important to any one division more than the other.

Another interesting feature in the embryonic stages is noticed in the large size of the tongue in proportion to the jaws. This is important in its influence upon the maxillary ridges and is of great significance in calling attention to the fact, that being so out of proportion in size if the growth of the jaws be arrested, and consequently failing to give space during the early childhood, which will enable free use of the tongue in speech, such children learn to speak with great difficulty, if at all, or, as might be expected, are reluctant to make the unusual effort required of them in learning to form certain words. Thus the brain cells, directing this action, do not develop, and in the course of time such children come to be considered defective, and ultimately are really so, because the speech centers are arrested in their natural progress. Undoubtedly many of these might have been at least approximately normal if this condition had been corrected at a sufficiently early date.

In the series of skulls shown, which were collected by Professor Prentiss of the State University of Iowa, one at about term and the others at different stages, until approximately the sixth year, viewed from front, profile and their basal aspects, we note the same progressive changes begun in embryo, becoming even more and more marked as growth takes place, and the modifications due to eruption of the deciduous teeth become apparent, and these in turn are affected by the development of the germs of the permanent set, until governed by the eruption of the first permanent molar, which Bogue has so ably called attention to as being one of the chief determining factors in the establishment of correct or incorrect occlusion of the permanent teeth.

With cases such as figures 4 and 5, where the hard palate is perfect, with deformity of the lip on one side, the fissure



extending through the alveolar ridge, there are both deflection of the nose and in the absence of yielding through the line of the fissure, with consequent widening such as usually marks this form of cases, also a forward projection of the premaxillæ, brought about through increased growth of bone, which takes place in the maxilla just behind the alveolar ridge.

In precisely the same way, when double harelip exists, as in figure 6, the projection of the premaxilla and the deformity of the vomer are accomplished by unusual growth of maxillary and other bone structures, caused by adverse muscular action. Thus we find that the result of any of these defects brings about, not only a symmetrical form, but change in actual bone growth as well, and while nonsurgical corrective measures applied to readjustment of form may be necessary and sufficient in many cases, when actual changes in bone growth has been brought about and there is consequently either more or less than normal bone structure in a region, measures must be adopted upon the one hand to cause an increased growth, or, upon the other, to accomplish the removal of superfluous bone before natural conditions can be resumed.

A rather striking example of this is shown in illustrations figures 7, 8, 9, 10. Both individuals were burnt at three years of age. Each was left to grow up with tension of scar tissue contracting muscles in the same region. In one case the muscular tension happened to be such as to cause elongation of the jaw, to correct the deformity of which a considerable portion was resected. In the other, muscular action stopped jaw growth, and in order to give the appearance of a mental process the soft tissue had to be molded to produce this effect.

If our line of reason and illustration have been sufficiently clear, it should be apparent that any influence which can affect intrauterine growth, and this includes arrest of development from any cause, be it hereditary, metabolic, incidental or accidental, can directly bring about or predispose the malformations of nose and mouth.

The result of adverse muscular action may be apparent at the time of birth. With the beginning of extrauterine influences all the conditions of the physiologic action of each or all parts concerned become active in determining normal or abnormal results. Whether adenoids and enlarged tonsils be the result of an already preexisting tendency to irregular cell development and asymmetric form growth in the individual, or due to restricted respiratory action or to some other influence, it is perfectly evident that with obstructive influence activity against natural respiration, correct nasal and oral form would be practically impossible.

To summarize the results of our investigations this far, we admit all of the etiologic factors that have been commonly, variously and individually urged by writers with the statement that any interference with continuous and complete embryonic growth will manifest itself in imperfect form, directly due to the arrested development and in asymmetrical exaggerations thereof, including alteration in both form and structure, by the imperfect physiologic action of the immediately affected and surrounding parts.

Second. After birth, any abnormal muscular activity, whether due to the unusual stress of habit, accident or other cause, will make its influence manifest in distortion of the form of the growing parts.

Third. With obstruction of the upper air passages complete symmetrical form of the palate and upper maxillary arch cannot as a rule be expected.

Conversely, any factor which tends to contract the form of the palate in such manner as to bring about crowded and high arched condition of the palatal vault, with the usually attendant saddle-shaped, narrow dental arch, must in greater or less degree tend toward contracted nares, deviated nasal septa and commonly associated nasal defects. For these reasons it is manifest that adenoids and enlarged tonsils, whether first or second in etiologic succession, are always and invariably contributing factors of first importance. The propriety of their removal as a corrective measure is obvious. We, therefore, wave discussion of the question of etiologic precedence,

since all treatment must resolve itself into procuring increased space for the purpose of more complete physiologic action in respiration and also room for development in the dental region.

As I have made it clear in previous writings upon this subject, the appliance I use for separating the maxillæ is merely an adaptation of well known orthodontic instruments and principles for this purpose, and the space that appears between the central incisors, which is indicative of division through the median maxillary suture, has been frequently noticed by many dentists and orthodontists, who have had it occur accidentally in the course of their treatment.

My only claim for originality lies, therefore, in the application of these principles in this way for the specific purpose of producing maxillary separation in order that widening of the nares and correction of nasal defects might be the direct result. It is undoubtedly true, that having thus obtained the increased size in the dental arch through expansion, the proper space allowed enables nature to correct many dental irregularities in considerable measure without further interference. In all cases, unless locked in lingual, labial or buccal occlusion, or for some other reason held in malposition by forces or factors which cannot thus be overcome, the natural tendency of all teeth is to seek their rightful positions in the dental arch and to assume proper occlusal relations.

I have previously estimated that about 75 per cent. of the orthodontia now considered as being required would be unnecessary if this simple procedure were performed at a sufficiently early date. Others have made somewhat higher estimates. Notwithstanding all this, I wish it to be clearly understood that this method is in nowise brought forward as a complete substitute for well known orthodontic systems, because the principles and methods of orthodontia are often necessarily employed to complete what has been accomplished by maxillary separation in order that the improved condition thus secured may be made permanent by correct occlusion of the teeth in both jaws. At the same time it is necessary to emphasize the fact that the movement of the teeth under



the kind of pressure exerted in the ordinary course of tooth regulation by orthodontists and dentists will not give the increased intranasal space or make possible the correction of nasal defects, in anything like the same degree, even in young children, and in adult cases it is extremely doubtful if any improvement of sufficient value to improve marked deflection of the septum could be secured in any other way than by direct pressure which will cause separation of the maxillary bones.

The reasons for this statement are exceedingly simple. The principles of the various orthodontic systems now in vogue require pressure which will cause a gradual movement of the teeth. The result of pressure so exerted is to cause bone absorption. This Talbot has amply proven.

There are many reasons why this is advantageous when applied to the correction of dental irregularities, but in order to carry the effect into the higher region of the nose, the less movement of the teeth through the alveolar structures takes place, the better the result will be, in so far as widening of the nares is concerned. It is because of this fact that more or less disappointment in results has occurred in some instances, when rhinologists have referred these cases to orthodontists and dentists, for, although the teeth in the course of time may have been beautifully straightened and symmetrical arches secured, the nasal improvement has not been such as it might have been, had the process of direct pressure here recommended been applied and a positive result obtained within a period of approximately two weeks.

Our practical illustrations of the truth of this statement are almost unlimited and could be multiplied by descriptions of cases in practice that have been cared for during the past few years in almost any number that might be desired. The pathologic explanation seems to be established with equal certainty when we consider Talbot's experiments on dogs and my own results of expansion upon green skulls, both of which are here given.

Talbot's experiments with regulating appliances in the mouth of dogs were as follows: The screws, which were given one-fourth, one-half and one full turn every evening, were 60 threads to the inch. The teeth of three dogs were moved  $1/240$ ,  $1/120$  and  $1/60$  of an inch daily, respectively.



The process in which the screw was turned one-fourth and one-half turn each day was continued for seven days; the one in which the screw was turned one full turn was continued for two weeks. The object was to set up pathologic changes in the alveolar process similar to those produced in the human mouth. Talbot's findings, proven by microscopic sections of jaws of the dogs thus treated, show beyond question that movement under these conditions is effected by the ordinary processes of bone absorption.

By reason of the surgical division, to which my practice is limited, through constant observation of the marked nasal and maxillary deformities, which occur in harelip and cleft palate cases, it has been impressed upon my mind that there are some principles having a direct bearing upon our subject, the rationale of which in nasomaxillary developmental relation can be more accurately observed in those cases than in the course of normal growth, because through the opening in the palate and in the lip the form of the nasal septums affected by normal conditions can be directly studied with the entire field in view. The resulting changes in form and structure of both osseous and cartilaginous nasal structures by adverse muscular action can also be plainly seen.

Although conditions may in many respects be radically different when there are no fissures through the palate or lip, the factors which play a part in determining both intra- and extranasal form results, though modified in degree, are in effect precisely the same.

The study of the illustration of a few of these cases and the results of their correction, with description of the principles which guided the method of their treatment, would seem to be advisable in order to lay a foundation, upon which the method of explanation of the method of correction, which is the subject of this discussion, must depend, since it is through the study of those cases and effects that we have been led to the adoption of this kind of treatment.

A few conditions in harelip and cleft palate cases appear to be invariable, notably in single fissure through both hard and soft palates. When the division extends completely through the naris on one side, we find the premaxilla attached to the opposite side, and through want of proper muscular control, by reason of the lip being open, in all cases

projects forward and is turned in the direction of the side to which it is attached. The maxilla upon the opposite side is drawn away from its fellow and backward through want of muscular tension in a forward direction, thus widening the fissure. The nasal septum in these cases is attached to the side upon which the premaxillary portion is united. The cartilaginous portion of the nose is always deflected to that side, also the ala upon the opposite side is flattened and more or less spread out, because its external angle is joined to one side, while the dividing cartilage is adherent to the other. In some cases the hard palate in the course of its formation extends upon each side of the fissure to a point where it forms a complete and clearly outlined border, from which upon one side the nasal septum extends more or less directly upward, with a noticeable though not severely marked bulging in the direction of the open side, upon which, of course, there is no floor to the naris.

In other cases of practically the same type the septum is so bulged as to appear to extend out upon the surface of the palate (see Fig. 11) until the clearly outlined border which should mark the line of demarkation between palatal and nasal tissues has become almost obliterated.

In double harelip cases, (see illustration Fig. 12, 13) the premaxilla is completely separated from attachment to the upper maxilla upon each side, therefore no continuous action between the labial and facial muscles is possible. In such cases there is an elongation of the vomer and of the lower border of the triangular cartridge, which causes the projection forward and typical deformity of the premaxilla and nose. The anterior portion of the upper lip, which is attached to the premaxilla, also fails to assume its proper size and shape. This defect is so marked in many cases as to give the appearance of lip and nose forming a straight line in a forward and upward direction. When there is complete fissure upon one side, with incomplete division upon the other, there is always a deflection of the projecting premaxilla which carries with it the attached nasal structures toward the side of the wider fissure. Figures 14 and 15 show the effect of failure to recognize these principles in surgical operation and the possibilities of later correction by surgical restoration

through observation of natural conditions. This is not an exaggerated example, for I have many such.

Illustration No. 16 is of particular interest in proving the possibility of complete fissure throughout the central median division in development of the face.

The infant here shown had not only fissure through the palate and central portion of the lip, but completely upward through the nose as well, the nasal septum being completely separated into two distinct divisions. A larger tumor, evidently a cyst, containing cerebrospinal fluid, completely filled the central portion of the mouth. The character of the fluid was not actually demonstrated, for fear of fatal result, but the anatomic form in maldevelopment was established beyond question in the operations which were performed to overcome the deformity.

I believe the defects to be accounted for by this double development of the nasal septum occur more often than is commonly realized. Not only is the effect noticeable in bulging or buckling on opposite sides of the same septum, but I have recently had under my care an infant, born with double harelip and cleft palate, in which there was a continuous line of attachment from the nasal septum to the maxillary division of the palate upon each side, the entire central portion being open and apparently not connected with the nares. This condition was discovered in an effort to pass a catheter through the nose for the purpose of continuing anesthesia during the operation for closure of the palate. The catheter, when inserted and passed through the nose, appeared quite close to the eustachian opening, and, very much to our surprise, could not be passed directly through into the wide open space in the center of the palate.

The best description of the double development of the anatomic parts of the nasal septum, the nasal processes, the vomer, the vertical plate of the ethmoid, the upper maxillary, the triangular cartilage and its caudal prolongation and the relation of the premaxillary wings, as affected by developing tooth germs, reflecting upon the form of the septum, has been given with supporting evidence from the anatomic room in an exceedingly complete series of illustrations by Harris Peyton Mosher, Boston, who states that "The septum at birth is almost cartilage. The only bony parts are the vomer and the



two premaxillæ and their processes. The vomer consists of two leaves of thin bone, which are united below, but are open and flaring above. This formation is a relic of its double origin, evidences of which the vomer never entirely loses. The premaxillary wings spring from the posterior half of the upper face of the premaxillæ. In the groove which they form rests the tip of the vomer. Two other processes spring from the superior surface of the premaxillæ, namely, the nasal spines. These again make a slight gutter, into which in its turn fits the tip of the premaxillary wings and the tip of the premaxillary wings. The tip of the vomer rests in the gutter of the premaxillary wings, and the tip of the premaxillary wings rests in the gutter of the nasal spines, like the arrangements of the sections of the old-fashioned wooden drain. The upper border of the adult vomer is gutter shaped, like the vomer at birth, the gutter not being so deep.

"A large number of deviations of the septum are caused by asymmetry in the development of the bones which make the hard palate. This inequality of the development is usually due to delayed or irregular eruption of the incisor teeth, especially of the middle incisor. When the eruption of one central incisor is sufficiently belated it causes a deformity or hypertrophy of the maxillary wing above it. This distorts the retaining groove made by the premaxillary wings. As a result, the septum slips from its bed in the vomer, and the grooves made by the two leaves of the vomer spread open, one leaf on the side of the vomer disappearing. This produces a spur along the upper edge of the vomer. As the cartilaginous part of the septum slips from its bed the lower edge curls upward and outward, so that its lowest portion becomes concave. Higher up on the septum this concavity gives place to a compensatory convexity. The convexity generally is towards the spur. On the side of the delayed tooth a short basal spur indicates the enlarged premaxillary wing. The upper wisdom tooth may deform the septum posteriorly. This asymmetry shows in the nasal notches anteriorly and in the choanæ posteriorly and in the mouth. Abundant dissecting room findings prove that deviations so started may extend far backward on the septum and become obstructive."

It is interesting to note that this evidently painstaking and exhaustive study of embryonic and later anatomic study, sup-



ported by evidence from the dissecting room, coincides so perfectly with the results of our study of maldevelopment and clinical experience in this region. With Mosher's illustrations and descriptions before one, there can no longer be a doubt of the practical corrective efficiency of a method which would separate the halves of these developing parts sufficiently to supply space for their assumption of the normal form, which had been denied them through insufficient room for proper development. The elaboration of the gutter form of the pre-maxillary wings and vomer, and other evidence submitted showing that with deviations of the septum the first tendency is to slip out of the trough which forms its natural resting place, makes plain the reason why straightening of the septum, even in adult patients, takes place in such marked degree when the maxillary bones are separated, a fact that has been proven over and over again in our clinical experience, but for which we have been somewhat hesitant about claiming to such an extent, as our result seemed to warrant, for we may now assume that the separation must necessarily reestablish the gutter form and allow the natural resilient septum to seek its proper resting place.

Obviously, the simple and most natural method of correction must lie, in so far as possible, in the application of force, which will directly overcome not only the first causes, but the secondary results as well.

The appliance that I use is constructed by attaching metal bands which fit the cuspids and one molar tooth upon each side of the mouth. These are attached by rigid metal bars which rest against the lingual sides of all intervening teeth. To these are attached a tube upon one side, into which fits a threaded bar nut adjusted to fit. These are so arranged as to make direct pressure across the palate at the point of greatest constriction when the nut is turned. Force thus applied is distributed against all of the teeth upon each side of the dental arch, and by turning the nut twice daily, continuing each time until firm pressure is felt, but no pain whatever experienced, the maxillæ can be separated through the median suture of the palate and division between the central teeth. When this occurs, the incisor teeth are moved apart, and, since the appliance does not touch them in any way, the only explanation is that the bones in which

their roots are embedded have been moved away from each other. Both intra- and extranasal measurements prove that in this movement the nasal bones and other attached parts have also been included, and the result is that there is a direct and immediate increase of space within the nares. To prove this definitely, similar appliances were adjusted to green skulls, an experiment which was made possible through the courtesy of Dr. Lea W. Dean of the State University of Iowa. Its result is shown in figures 17 and 18, in which the parted sutures can be plainly noticed, with increase in actual measurement of one-eighth of an inch across the base of the nose and one-sixteenth of an inch across the upper third.

The following cases, though previously reported, are fair examples of the usual clinical results, and are submitted as additional evidence of the truth of our theoretical foundation and the practical efficiency of this method of treatment.

Figure 19 shows a young man, aged 29, whose nose was injured by a baseball in early youth. Dr. Nelson M. Black, by whom the patient was referred to me, found the septum buckled in such a manner as to give almost complete stenosis of one naris, the turbinal bodies much enlarged, and hypertrophic conditions generally marked. The patient was greatly troubled by attacks of sneezing when he bent his head downward. The appliance was adjusted April 6, 1908. Within two weeks the space between the central incisors appeared as shown in figure 20. Actual enlargement of the nares was confirmed on examination by Dr. Black, and by the improved breathing experienced on the part of the patient himself, thus proving that even at this patient's age the desired result had been quickly accomplished. Most of the time the patient, who resides in another city, was at a distance from me, and had the appliance turned by one of the members of his family.

Figure 21 gives the actual measurement with a millimeter gauge of two casts of the mouth of a lad of thirteen years, one taken before the arch was separated, the other at the time when the division through the central incisor was evident, and his rhinologist, Dr. J. A. Bach, of Milwaukee, reported sufficient improvement of his nasal condition. This is a fair example of the approximate increase in width of the palate that is required in such cases.

To these might be added a long list of other patients who

have received the same treatment with precisely the same result in my practice during the past few years, if repetition by citation of other cases were either necessary or advisable. All these cases show deviation of the nose from the central facial line, an imaginary, though clinically a very useful, line, to which I have previously called attention, taken through center of forehead, tip of nose and center of chin. Deviation from this line, one way or another, is a fairly certain indication of perverted nasal and maxillary growth, leading almost invariably to pathologic nasal conditions.

Especially among growing children treated by this method has there been marked physical improvement, tendency to growth in height, as well as general development and increase in weight. Many of these had previously been unable to attend school regularly because of the tendency to nose, throat and bronchial affections. Nervousness was almost invariably very greatly relieved, and this, it is believed, for two reasons. First, the well understood results from the improvement in breathing apparatus, with general healthfulness to be expected from better aeration and freedom from diseased nasal secretions; and, second, the relief of that condition to which Kiernan has called attention, caused by crowding together of the dental arches, with tendency to nerve irritation. This condition quite frequently manifests itself, not only in increased nervousness of a general character, but also in the development of neurotic tendencies leading to chorea, epilepsy and other similar affections, which, in some instances at least, might perhaps have been averted if these patients could have been tided over critical periods in their development. This has been recognized by Dr. Talbot as one of the periods of stress. Certainly it is a curious fact that even with the disadvantage of having the appliance in their mouths and the bar across the palate, children who are subject to such pathologic conditions almost immediately become less nervous, have increased appetites, and general development goes forward almost from the very first few days after pressure has begun to be exerted.

I can not help feeling that this treatment can be made a very great factor in safeguarding against tuberculosis. It is so easily accomplished and the results are so greatly beneficial that it should be applied to hundreds and thousands of



growing children, who are unquestionably more susceptible to pneumonia and bronchial affections because of imperfect breathing. It offers a possibility of relief which is especially important on account of the fact that such defects are well known to be on the increase, arrested development in the maxillary region being more marked in each generation under the conditions of our so-called civilization.

In final proof of the truth of all the foregoing theoretical and clinical conclusions I am privileged, through the courtesy of Dr. Lee W. Dean of the State University of Iowa, to submit the following record of the case of a young girl of 17, a patient of Dr. Dean's, for whom I performed maxillary separation to aid the correction of serious nasal and other defects. These measurements were made with an instrument invented by Dr. Dean for the purpose, and taken by his associate, who had no special interest in the case, and whose accuracy could in nowise be consciously or unconsciously affected by any preconceived idea or expectation. They are therefore absolutely correct.

	A.		B.		C.	
	May		Aug.		Feb.	
	28, '09.		11, '09.		18, '10.	
	R.	L.	R.	L.	R.	L.
Ant. end Inf. Turb. to Sep.....	5	6	8	9	9	10
Middle of Inf. Turb. to Sep.....	5	4	7	6	7	6
Post. end Inf. Turb. to Sep.....	10	12	10	12	12	12
Ant. end Mid. Turb. to Sep.....	2	2	2	2	4	4
Mid. of Mid. Turb. to Sep.....	1	2	2	2	2	4

Having thus fully demonstrated the practicability of the improvement of nasal deformities and attendant disease by separating the maxillary bones and directly increasing the size of the nares, it only remains for us to prove that constriction or arrest of growth in width across the palate could cause deviated septum, contracted nares, or even complete nasal stenosis.

This I am able to do through the courtesy of Parke-Davis, in whose Biological and Research Department I was permitted to do some original work on puppies, and the able assistance of Dr. Ferry and his associates in the laboratory. Several pups eight weeks old were operated upon by passing a wire through the maxillæ from a point above the roots of the teeth upon one side above the palate and out at a corresponding



point upon the opposite side. The palate was compressed sufficiently to force the upper teeth inside or in lingual occlusion with the lowers, so that the upper and lower jaws of these puppies were placed in about the same occlusal relation that exists with growing children whose bicuspid teeth meet the corresponding lower teeth in lingual (inside) instead of buccal (outside) or normal occlusion. Not nearly so much force in compression was used as would be necessary to close a case of palate fissure according to the method which was formerly widely practiced upon infants with cleft palate. The purpose was to reproduce as nearly as possible the maxillary condition of typical cases of mouth-breathing children. One pup was kept without operation as a control, and all were allowed to develop until they reached the age of six months, which, it was estimated, would approximately correspond to the age of a child of eight or nine years old. The puppies were then killed, the heads frozen, and sections cut through the nose and upper jaws at short intervals. The result is shown in Fig. 22, a, b, c, d, e, and Fig. 23, a, b, c, d, e. Marked difference between the nares will be noted throughout both series, but the section marked c in each is exactly at the point where compression was made. The almost complete stenosis in Fig. 23 contrasting quite strongly with the same section in Fig. 22.

The laboratory record shows that all of the puppies in this litter, under the same care and with the same food for a time thrived equally well, and their growth was about the same. During the latter portion of the period, when the effect of the compression upon nasal growth became apparent, the control dog continued to grow and thrive, but those operated upon became emaciated. One died shortly before the expiration of the trial period. The one shown in the illustration was a mere mass of skin and bone. The remaining puppy showed marked congestion of the lungs. Experiments conducted in the Parke-Davis laboratory by the late Dr. Willis S. Anderson, of Detroit, who produced partial stenosis in dogs by suturing the external nasal openings, and by introduction of packings in several ways, demonstrated, that while the mucous membrane of the bronchi of dogs in good health is practically immune to pathogenic microorganisms, when their breathing is affected, they become highly susceptible to every sort of

infection in this region. Such dogs become almost entirely hairless, and the puppies of such mothers in some instances lost their hair also.

As is well known, children who are mouth breathers because of adenoids and enlarged tonsils, arrested or perverted nasal development, are frequent sufferers from coughs, colds and other evidences of infectious processes in this region. The same is true with older persons in corresponding degree.

Having thus been able to cause deviated nasal septum and contracted nares by arresting maxillary development and to correct these deformities and their attendant ills by maxillary separation, it seems fair to assume that our case is complete.

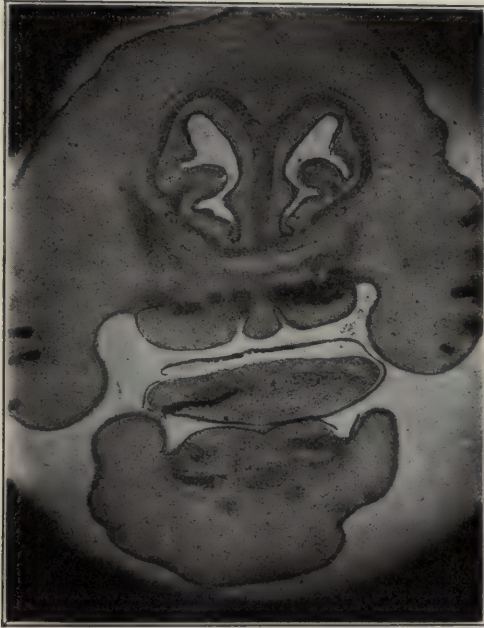


Figure 1. Section through the head of a human embryo at approximately the fifth to seventh week, showing fissure in the premaxillary and palatal region united.





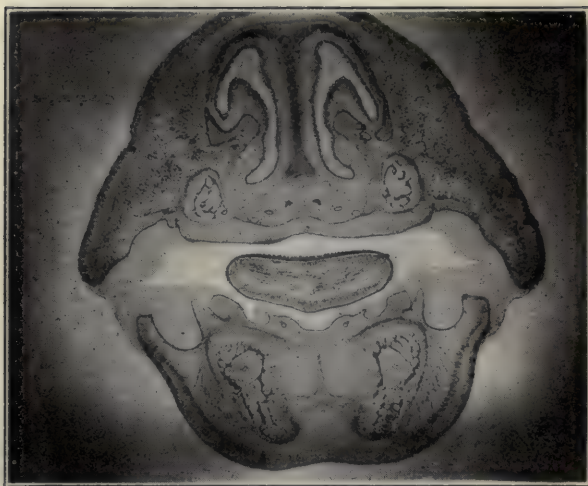


Figure 2. Section through the head of a human embryo at approximately the eleventh to twelfth week, with palate completely united. Progressive enlargement of the nares, bone and tooth development indicated.

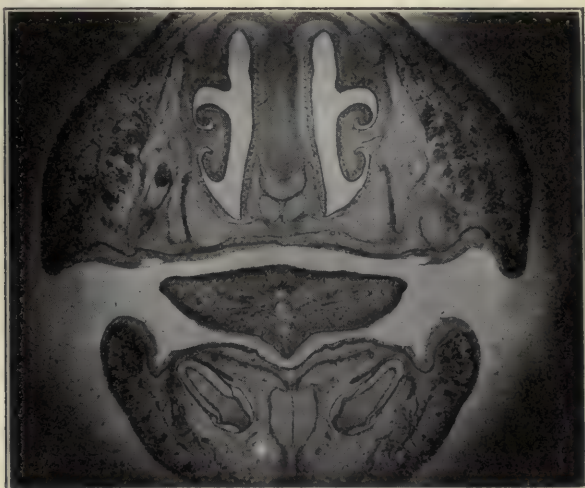


Figure 3. Section through the head of a human embryo at approximately the twentieth week, shows developing teeth high up at each side of the now much enlarged nares. Double development of the nasal septum. The tongue large and much in advance of the lower jaw, in which tooth follicles are now clearly outlined.





Figure 4. Little girl of six years, with harelip, fissure extending through the alveolar ridge only, shows deflection of the nasal septum and triangular cartilage of the nose, flattening of the left cartilaginous wing, and a permanently fixed deformity of the premaxillae.



Figure 5. The same girl after forcible correction of the deformity and closure of the lip.







Figure 6. A typical case of double harelip and cleft palate showing characteristic deformity of the nose and palate.





Figure 7. Man of 22, burned at three years old. Scar tissue in this case caused elongation of the lower jaw so that the upper exposed teeth occluded with lower molars.



Figure 8. Same individual shown in Fig. 7, after operation. The unusual thickness in this case was taken advantage of to carve out a chin after removal of the teeth and external plate. The soft tissues were readjusted upon the newly formed bone structure.



MISS MARY ANN BROWN



MR. JAMES BROWN





Figure 9. Boy of 14, burnt at about three years old. In this case the effect of the tension of scar tissue was exactly opposite to the case shown in Fig. 7. The growth of the jaw was almost entirely prevented.

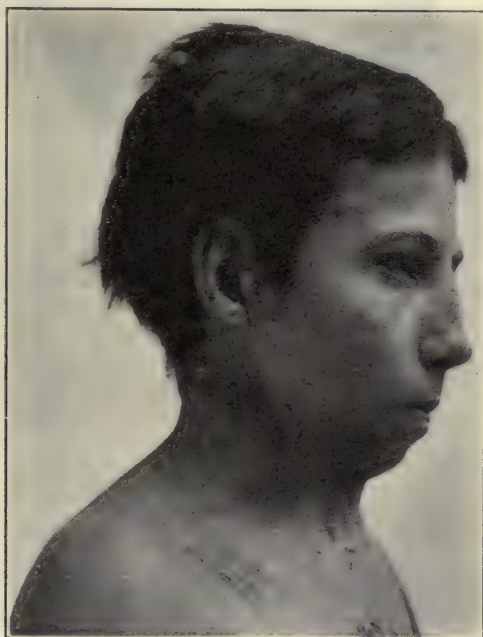
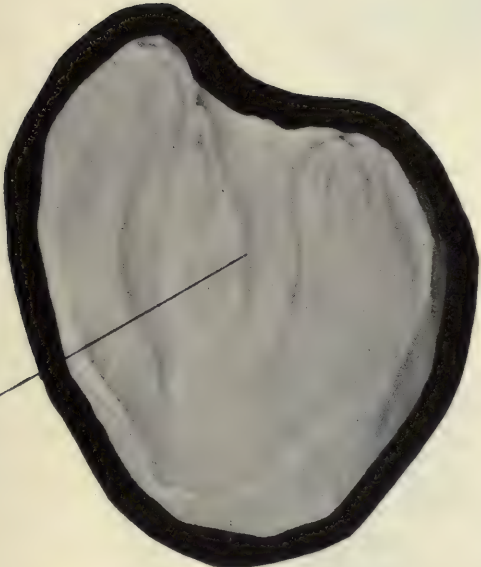


Figure 10. The same boy after operation. By removal of the scar tissue covering the skin grafts and moulding a chin out of soft tissue to supply the deficiency in the region of the mental process.





Enlarged  
turbinate.

Figure 11. Cast of mouth of infant with harelip and cleft palate. The septum of the right side is so bent and extended toward the left that a line of demarcation between septum and palate on the right side is almost obliterated.





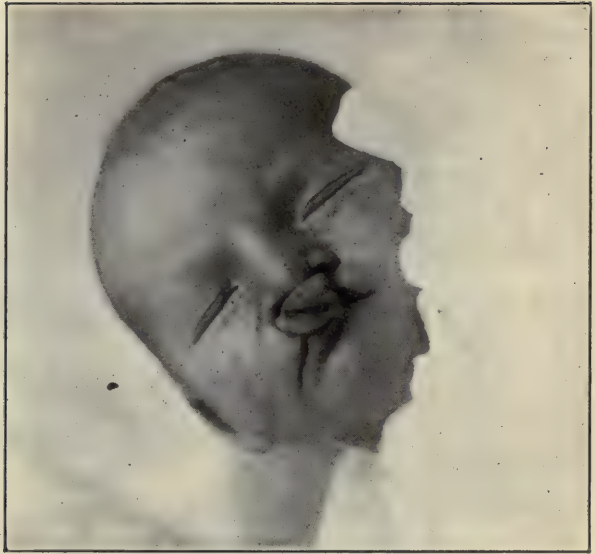


Figure 12. Baby with double harelip and cleft palate showing typical deformity.



Figure 13. The same baby shown in Fig. 12 after operation. In the case of this baby the steps of treatment were: (a) First, correction of deformity with adhesive strips across the face. (b) Closure of the lip and adjustment of the cartilaginous wings of the alae of the nose. (c) Closure of the hard palate two or three months later. (d) Completion of the case by closure of the soft palate. The child has normal development of the mouth, teeth erupted in proper position and a full, flexible, soft palate as well as symmetrical external features.





Figure 14. A young man whose lip was operated upon in early infancy without due consideration of developmental principles.



Figure 15. The same individual shown in Fig. 14 after reoperation upon the lip and readjustment of the deformed parts.



JOHN W. BROWN, President of the Board of Directors, 1887-1888.  
A member of the Board of Directors, 1887-1888.



JOHN W. BROWN, President of the Board of Directors, 1887-1888.  
A member of the Board of Directors, 1887-1888.





Figure 16. Baby with harelip and cleft palate having also a groove through, dividing the nose into two parts with one-half of the septum upon each side, this double development evidently extending completely through to the cranial cavity.





Figure 17. Skull with appliance in position and median suture separated.







Figure 18. Another view of the same skull shown in No. 17. The division between the central incisors and separation of the suture up to the nose is shown.





Figure 19. Young man, age 19, with nose injured in early youth. Badly buckled septum and almost complete stenosis of one naris.

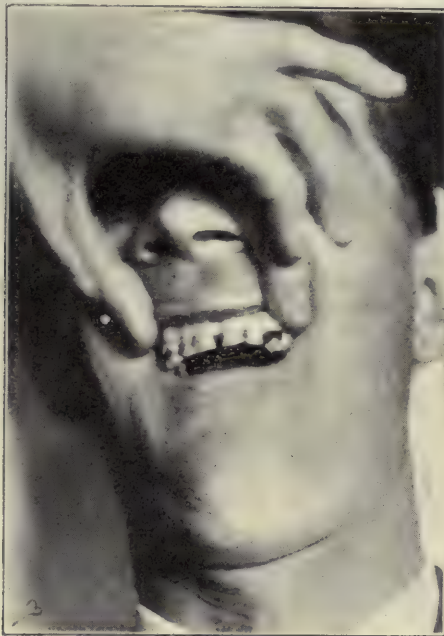


Figure 20. Same young man about ten days later. Separation between the central incisors confirmed by intranasal examination, which disclosed enlargement in this region, evidence maxillary separation.





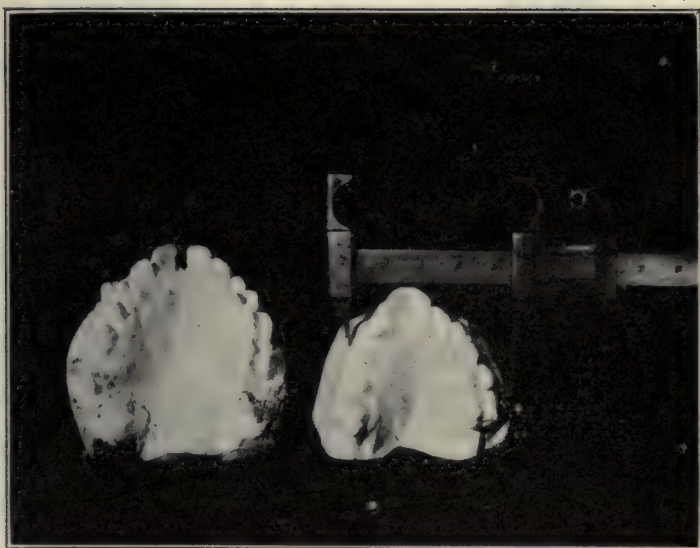


Figure 21. Casts of the mouth of a boy at 14, before and after expansion. The space between the central incisors closes itself in the course of time without operative influence.





Figure 22. The same age as Fig. 23, upon which no operation was performed.

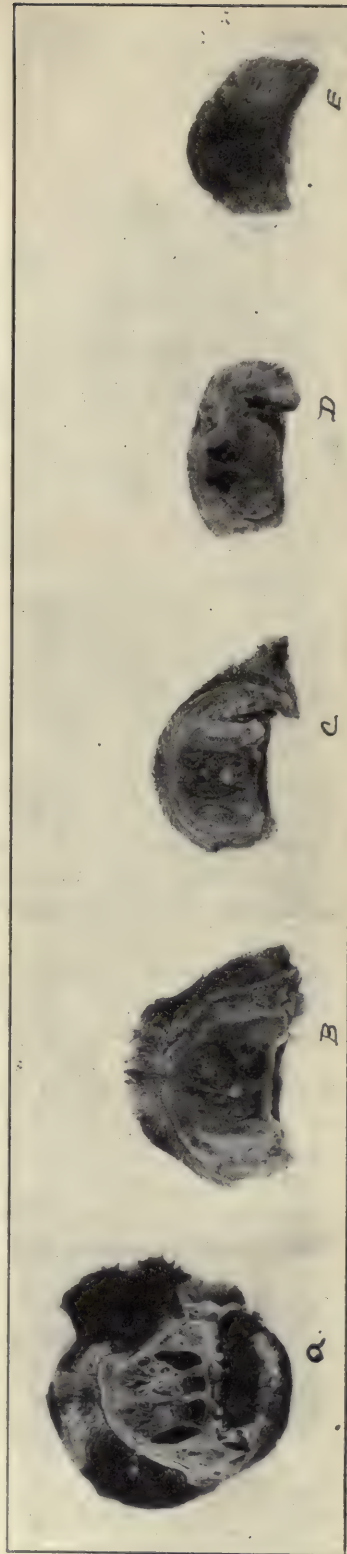


Figure 23. Sections of head of puppy six months old, with jaws arrested in development across the palate by wiring at eight weeks old. These sections show plainly the contracted effect upon the nares, the deviation of the nasal septum, especially the section shown in c, the point at which the wire was inserted and development arrested.





## LVI.

# WIDENING THE DENTAL ARCHES IN NASAL STENOSIS; ITS RESULTS AND POSSI- BILITIES.

BY NELSON M. BLACK, M. D.,

MILWAUKEE.

### SEPTAL DEFLECTIONS.

Practically all rhinologists ascribe to irregularities of the upper maxilla an important place among the etiologic factors of septal deformities; still very few select correction of these irregularities as a means of correcting the septal deviations.

Of the rhinologists who have had ocular proof of the results by spreading the dental arch in what seemed to be typical cases of deflected septa, a few have become converts; some have admitted its possibilities in selected cases; while others have said operative procedures upon the deformed septum itself was the only method.

The results obtained in the cases referred to Dr. G. V. I. Brown have without exception shown marked improvement; naturally, some more than others, for reasons to be mentioned later.

Dr. D. B. Kyle<sup>1</sup> rightly says that of the many operations for the correction of septal deflections, each was suggested by its author for a particular variety of deflection, and that much discussion and confusion has been caused by the fact that other operators adopt the methods for varieties of deflection to which they are not adapted. The results being unsatisfactory, the method is condemned.

The varieties of septal deflection are infinite, and, although some authors attempt a classification, no two are alike. From my understanding, the same may be said of dental and maxillary irregularities. As a result, no definite rules can be laid down as to treatment, each case being a law unto itself.

## OBJECTS TO BE OBTAINED IN CORRECTING SEPTAL DEFLECTIONS.

The objects to be obtained in treatment of septal deflections are: First, to establish free nasal breathing; second, to restore the septum to the median line with its surface as smooth and even as possible; third, to equalize the space on either side of the septum; fourth, to leave the mucous covering of the nasal interior as little injured as possible, so that its functions may not be impaired.

The first thought that comes to one on looking into a nose having a septum with a marked deflection is that more space is needed, and that something must be removed to obtain this. There is no doubt that there is seemingly superfluous tissue in the largest percentage of these cases, when compared to the nasal space in which they are found, but the fact that the nasal space is much smaller than it should be is, as a rule, not taken into consideration.

The removal of tissue, such as turbinates and thickened portions of the septum in overcrowded nares, is beneficial, but does not correct the deformity of the septum. In many instances, however, the removal of too much tissue (which is a fault with many operators) is a real source of danger. It would seem far better to increase the size of the nasal fossæ first, and then proceed to the removal of any superfluous tissue, should it be found necessary.

This can be accomplished, but, so far as my knowledge goes, only by widening the arch of the superior maxilla. This procedure, to be effective in enlarging the base of the nares, must be essentially different from the ordinary expansion for the regulation of the teeth in abnormal position.

Several dentists, whom patients have selected to do this work, have attempted to widen the upper maxilla by a slow, torturing process of expansion, which exhausted the patience of the individual long before the desired results were accomplished.

Dr. G. V. I. Brown<sup>2</sup> accomplished this result 11 years ago in the case which first started my investigations along this line. He is the only man with whom I so far have personally come in contact who succeeds in obtaining the results desired and absolutely without discomfort to the patient and in an incredibly short time. We have differed to a certain extent as to

how the result is brought about. Dr. Brown believes it is produced entirely by separation of the median palatal suture, which is manifested by the increased space between the middle incisors.

My theory is that in addition to this separation there is a real lowering of the vault, the result of an outward tilting of the alveoli. I can not see how the septum could be so materially straightened, which is the case in practically every instance, unless the vault is lowered and allows the septum to straighten by its own resiliency. However, when one considers the very small amount of vertical shortening found in a badly deflected septum, it is necessary to realize that but little space is required within which it may become straight. The ever-present resiliency and elasticity of a deviated septum will tend to cause straightening if the pressure at the base of the septum is relieved.

This relief of pressure occurs when the palatal suture is opened in the process of widening the superior maxilla, as evidenced by separation of the incisors. There is, however, another class of arches with deviated septa where beneficial results are obtained, in which some other movement must take place, as in this class there is no visible separation of the incisors.

What does take place must be either a separation of the median suture back of the premaxilla, or else (and Dr. Brown says he is afraid he must concede to the latter) an actual lowering of the vault occurs. In either case 2 or 3 mm. increase of vertical space would result, which is all the septum requires within which to straighten itself.

#### WHY THE OLDER OPERATIONS WERE NOT EFFECTIVE IN SEPTAL DEFORMITIES WITH DENTAL IRREGULARITIES.

Before the introduction of the submucous resection for deflected septa the various operative procedures gave but indifferent results, and in many cases there was a return of the deformity. This was due largely to the fact that the main etiologic cause remained—that is, some dental or jaw irregularity—with lessened resistance in the operated septum, the result being a consequent tendency for the deformity to return. There was no increase in width of the nasal fossæ; the trans-

mission of the force of mastication through the irregular superior maxilla and septum helped to maintain the deformity and to keep up the congestion in the nose; the result being that the turbinal bodies did not tend to diminish in size. This latter feature is also active in the nose after submucous resection, as the dental irregularity still remains.

THE AGE AT WHICH TO WIDEN THE DENTAL ARCH FOR DEFORMED  
SEPTA ACCOMPANIED BY DENTAL IRREGULARITIES.

The earliest deflected septum which has been reported is by Bishop, in a child of five years and nine months. Most authorities state that its occurrence is rare under six or seven years of age.

Dr. Kyle<sup>1</sup> referring to mouth breathing and its resultant developmental deformities, says that unless perfect nasal breathing is established early in life—that is, before the fifth or sixth year, or not later than the seventh—the bony cartilaginous framework becomes so firm that little can be done towards increasing the nasal space for breathing, and the individual will of necessity become a mouthbreather for life.

Taking the rhinologic standpoint, this statement seems reasonable, but from an orthodontal viewpoint the situation changes. Gray<sup>3</sup> states:

“The superior maxilla commences to ossify at a very early period, but the suture between the palate processes persist until middle life.”

This being the case, the jaw may be widened at any time before this.

The first patient referred to Dr. Brown for treatment, in 1899, was 33 years of age. She obtained a perfect result.

RESULTS OF SPREADING PALATAL ARCH IN DEFLECTED SEPTA.<sup>4</sup>

Expansion of the maxilla relieves the pressure on the septum, which tends to straighten itself. There is an actual increase in width of the base of the nose; the breathing space being enlarged allows the nose to functionate. The volume of air being increased, the static congestion disappears, with a reduction in the size of the turbinate bodies, resulting in a further increase in nasal space.



This state of affairs should be allowed to continue until no further increase in nasal space is noticed and the turbinated bodies have decreased in size as much as possible before deciding if any tissue should be removed.

The patient is, as a rule, so well satisfied with the increased breathing space and relief from the disagreeable symptoms produced by the stenosis and congestion that he considers operative procedures in the nose unnecessary. This, however, is not always so. The removal of a spur, a portion of an hypertrophied turbinate body, is in some instances required. Very rarely have I seen cases where a submucous resection of a portion of cartilaginous part of the septum would have improved the appearance of the inside of the nose but the patients would not submit to an operation in their improved state.

#### RESULTS OF SPREADING THE PALATAL ARCH IN CHILDREN WITH BEGINNING NASAL STENOSIS.

The improvement, physically, in children with beginning nasal stenosis is very marked. This has been referred to by Dr. Brown,<sup>5</sup> i. e.: "Especially among growing children treated by this method has there been marked physical improvement, tendency to growth in height, as well as general development and increase in weight. Many of these had previously been unable to attend school regularly because of the tendency of nose, throat and bronchial affections. Nervousness was almost invariably very greatly relieved, and this, it is believed for two reasons: 1, the well understood results from the improvement in the general breathing apparatus with the general healthfulness to be expected from better aeration and freedom from diseased nasal secretions, and, 2, the relief of that condition to which Kiernan has called attention, caused by crowding together of the dental arches, with tendency to nerve irritation. This condition quite frequently manifests itself, not only in increased nervousness of a general character, but also in the development of neurotic tendencies leading to chorea, epilepsy and other similar affections, which, in some instances at least, might have been averted if these patients could have been tided over critical periods in their development. This

has been recognized by Dr. Talbot as one of the periods of stress. Certainly it is a curious fact that even with the disadvantage of having the appliance in their mouths and the bar across the palate, children who are subject to such pathologic conditions almost immediately become less nervous, have increased appetites, and general development goes forward almost from the very first few days after pressure has begun to be exerted."

RESULTS OF WIDENING THE SUPERIOR MAXILLA IN CASES OF  
CONSTRICTED NARES WITHOUT A PATHOLOGIC OBSTRUCTIVE.  
LESION IN THE NOSE.

Patients are frequently seen who say they have never breathed well through the nose. The condition found and the results obtained are well described by Dr. Dean,<sup>6</sup> who is quoted:

"Examination of the nose shows turbinates normal in size and structure, septum slightly deflected, as is usually the case in all noses, or markedly deviated, no exostoses, but the inferior turbinates pressing against the septum, or against the floor of the nose, or usually both, which is, of course, an abnormal condition. Adenoids may be present, but their removal does not give the usual relief. The palatal arch is constricted and, of course, there are malpositions of the teeth.

"I have patients fifty years of age with the condition above described who have never had proper nasal respiration, and in whose cases no operative procedure on the nose is indicated. In many cases like these turbinates have been entirely removed in the effort to secure breathing space. This procedure, because of its serious sequela, is never indicated except for diseased turbinates. The respiratory function of the nose may be lost by such a procedure. Even if performed, it does not give good results, as far as the breathing is concerned, because the anterior nares are so slit that in respiratory effort the alæ of the nose are brought against the septum, and nasal occlusion, in part at least, produced.

"If the nose is constricted because of a narrowing of its walls, what is rational therapy? The only answer possible is this: The nasal walls should be separated and the cavities thus widened. This can be accomplished in only one way, and

that is by widening the palatal arch. That the nose is widened by this procedure we all know. We have all had patients who have told us that widening the arch has improved nasal respiration."

INTRANASAL MEASUREMENTS BEFORE AND AFTER WIDENING THE  
PALATAL ARCH IN A GREEN SKULL.<sup>0</sup>

The result of spreading the superior dental arch in a green skull, which Dr. Brown and I did at Dr. Dean's request, is shown in the following measurements:

1. Distance across the posterior nares just posterior to the inferior turbinates: before widening, 32 mm.; after widening, 34 mm.
2. Distance across the posterior nares just above the posterior end of the middle turbinates: before widening, 23 mm.; after widening 24.5 mm.
3. Distance from the vomer to the outer wall of the nose in the posterior nares half way from the posterior end of the inferior turbinate to the floor of the nose on the left side: before widening, 17 mm.; after widening, 18.5 mm.
4. Same measurements on the right side: before widening, 24 mm.; after widening, 24 mm.
5. Distance between the anterior attachment of the inferior turbinate in inferior portion of the middle meatus of the same point on the opposite side: before widening, 23 mm.; after widening, 25 mm.
6. Distance between vomer and inferior turbinate at narrowest part of inferior meatus, left: before widening, 6 mm.; after widening, 7 mm.
7. Same measurements on the right side: before widening, 8 mm.; after widening, 7 mm.

POSSIBILITIES OF WIDENING THE PALATAL ARCH.

Dr. Bogue<sup>7</sup> has outlined the possibilities that may result from the spreading of the upper maxillary arch:

"If irregularities are found among deciduous teeth, irregularities of the same nature, but still more pronounced, may always be expected in the permanent teeth which are to follow these deciduous teeth. If no perceptible irregularities of the deciduous teeth exist, and at five and one-half or six years

no separation of the deciduous incisors has taken place, we are certain that development of the arch of permanent teeth has been arrested and that there will be irregularity of the front teeth, because the permanent teeth, being larger than the deciduous teeth, need a larger arch in which to erupt."

Such an arrest of development is shown in the accompanying plate.

"The early diagnosis of cases of irregularity is readily made if one carefully notices the articulation of the deciduous molars. In normal cases the articulation is always correct; that is, the anterior cusp of the lower second deciduous molar articulates forward of the corresponding deciduous molar above, and the upper molar is astride the buccal row of cusps of the lower molars.

"Whenever these upper and lower deciduous molars articulate in any other way than this, there is sure to be irregularity in the permanent teeth if they are allowed to develop without interference. The reason for this is that the crown of the permanent teeth is embraced by the roots of the deciduous molar.

"If the first permanent molars, which erupt immediately posterior to and in contact with the second deciduous molars, are not properly articulated, it will be impossible that the other grinding teeth should be. If the upper arch is abnormally small, we may be certain that there will not be room for the anterior permanent teeth unless an enlargement of the arch is resorted to.

"If such enlargement takes place sufficiently early for the roots of the permanent teeth to be formed after their crowns shall have been drawn into correct positions, there will never be irregularities in the positions of these teeth, and it follows, of course, that they will stay where they belong.

"On the proper formation of the palatine arch and the various sinuses depends the resonance and carrying qualities of the voice, and on the accurate formation of the dental arches and the correct occlusion of the teeth depends the power of clear and distinct enunciation and the power of thorough mastication, which means insalivation. This is the first step in the digestive process important to the health and strength of the individual. It has only recently become known that impending defects of the kind here mentioned may be discov-



ered in early childhood and may be remedied while the bones are in a formative state and the teeth are in process of development.

"My conclusion is that in those cases in which a rapid spreading of the upper maxillary is applicable—that is, in which permanent teeth are sufficiently developed and erupted for the operator to be able to attach his apparatus firmly and to apply the necessary force promptly, that the method is distinctly preferable for the correction of the class of nasal stenosis that has been under discussion.

"When, however, the difficulty is recognized early enough to have it corrected by means of apparatus attached to the temporary teeth, I have found that the latter method, being to a great extent preventive, becomes distinctly preferable.

"When slight pressure is brought to bear in these regions to overcome the 'restrictions in the region of the palate and alveolar structures,' it is in the direction of normality that the pressure is applied, hence the resumption of the proper functions of the parts is soon brought about, and with the performance of function comes development, and it comes so easily in many cases that we hardly realize that the deformity has been overcome until we see before us a normal condition."

Dr. Brown has found little or no difficulty with the great majority of cases in placing the apparatus for rapid expansion upon the temporary teeth and obtaining a satisfactory result in from ten days to three weeks' time, which is a decided advantage over wearing an apparatus for seven months, as in the case of Dr. Bogue's, illustrated above. However, that is a question which the oral surgeons must decide.

The thought has occurred to all of you before now that many cases of marked septal deviation has come under your observation in which the individual seems to have a perfect occlusion and there appears to exist no dental irregularity.

The question arises as to what is the proper course to pursue.

Through the discovery by Dr. I. B. Davenport of what constitutes a normal dental arch and Dr. Bonwill's discovery of the mathematical relation existing between the width of the permanent upper incisors and the size and shape of the entire arch of the upper maxilla, we have a means of determining whether or not there does exist any dental irregularity or deformity. Dr. Hawley's application of Dr. Bonwill's formula

to orthodontia results in being given the width of one upper central incisor, the approximate shape and size of the arch to which the tooth is a member may be outlined upon paper so accurately that one may proceed to the alteration of any arch according to such a plan with absolute confidence.

Such conditions existing, it would seem best for us as rhinologists to determine whether or not we are dealing with an individual with a normal arch (which Davenport determined was a rare occurrence in civilized communities) or one in which there has been an arrest in development, before attempting any operative interference in the nose.

The question to be settled appears to be this: Given a case in which we have insufficient space for proper nasal breathing, with an arch with seemingly perfect occlusion, is it our duty and have we the right to alter the shape of the maxillæ and rearrange the occlusion to allow the nose to properly functionate?

128 Wisconsin St.

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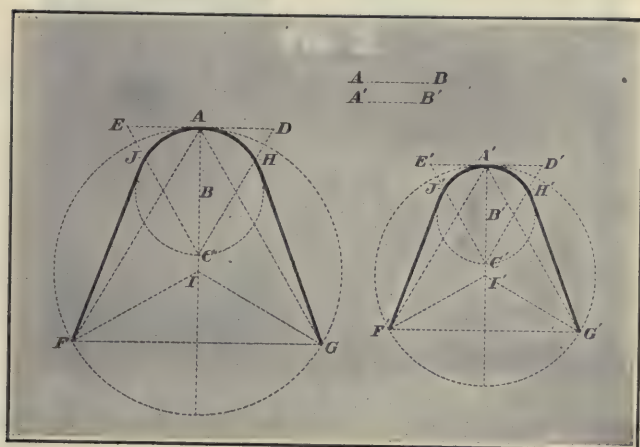


Figure 1. Mathematical drawing made from measurements of the width of three upper front teeth, showing the shapes and relative sizes of the arches constructed from the teeth of different widths. (After Bogue.)



Figure 2. Mathematical drawing (see Fig. 1). Teeth have been filled in according to measurements. (After Bogue.)





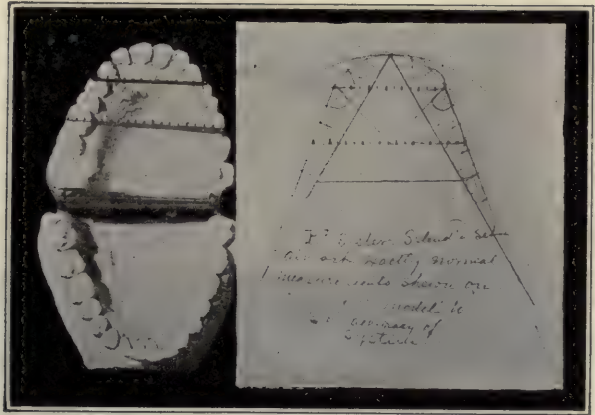


Figure 3. Model of normal teeth to show accuracy of system of measurements. (After Bogue.)

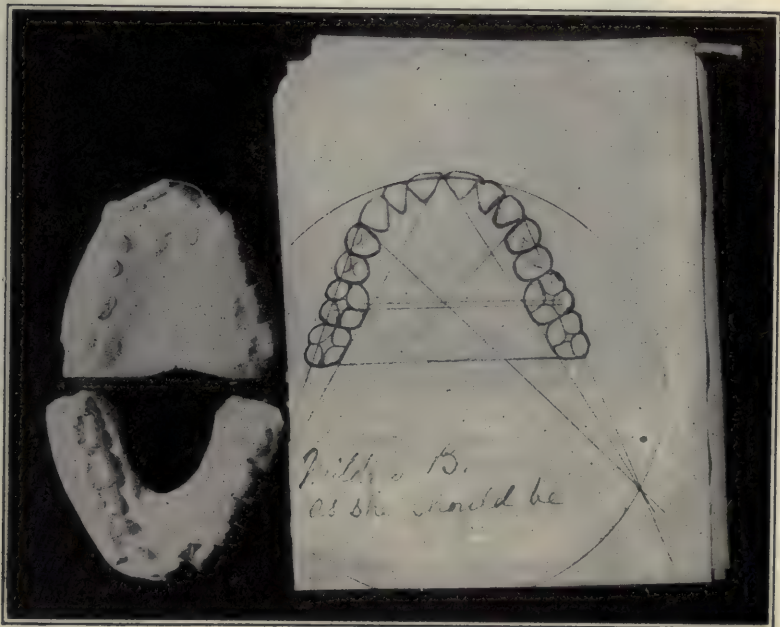
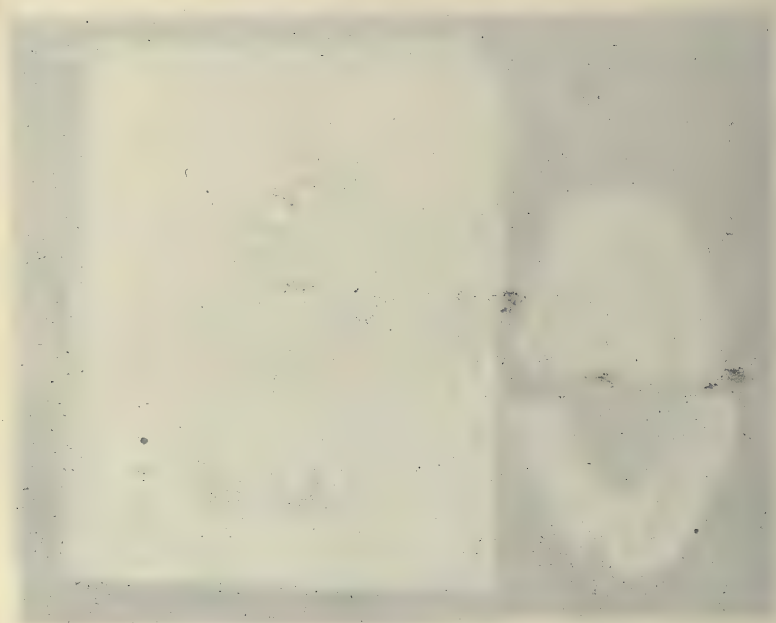
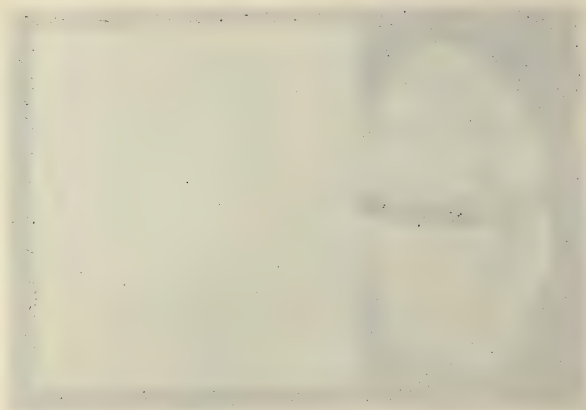


Figure 4. Model of narrow arch, with corrected shart showing teeth as they ought to be. (After Bogue.)



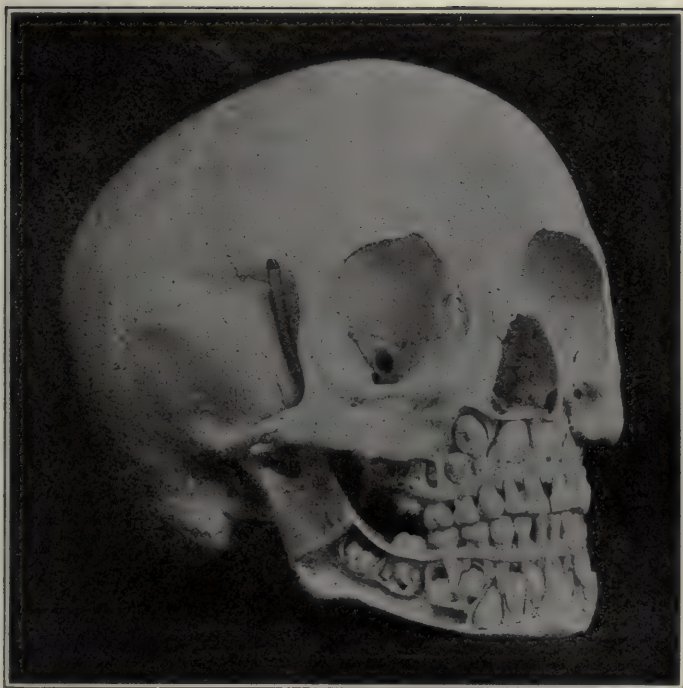


Figure 5. Showing crypts of the permanent teeth bunched in insufficient spaces in child's skull. (After Bogue.)







Figure 6. Four models of the same mouth, showing scarcely any lateral growth for three years and a lateral enlargement of 1 cm. in seven months after an expansion arch had been adjusted. (After Bogue.)



## LVII.

### SOME POINTS IN THE COMPARATIVE ANATOMY OF THE LARYNX IN THE ANTHROPOIDEA.

BY J. GORDON WILSON, M. D.,

CHICAGO.

As laryngologists we are specially interested in an organ which comparative anatomy shows has evolved from a protective mechanism placed at the entrance to the respiratory tract whose two muscles functionate as dilator and constrictor. Through slowly progressive developmental stages the simple anatomic structure requisite for this primitive physiologic function has been modified with correspondingly additional activities, till now we see a peripheral mechanism in which the primitive action is completely overshadowed by a physiologic function which may be called inter-relational, a function which has passed beyond the limits of the larynx and has reached its highest significance in the close intercourse which it renders possible between mankind. While voice is not confined to man, yet here it has reached its culminating grandeur and importance, a consummation which would appear to mark it off from all other peripheral organs. While not regarding the larynx with its functional expansion as playing a role so important in the phylogenetic history of the race as the central nervous system, yet when one notes the marked developmental progress which a study of comparative anatomy demonstrates, and when one recognizes the important part which the voice plays in the social progress of mankind, the philosophic laryngologist may well ask how much influence has this laryngeal development had on man's superiority. The more he philosophizes, the more certain he becomes that this organ, adapted for inter-relational life, is better fitted for comparative study than many which have attracted greater attention. With such a comparative history to point to and with the obvious probability that progression may still be present, one may well ask, has this development reached its culmination, and if not, along what lines is it tending? In the long and intricate path which comparative anatomy maps out in laryngeal progress, some

stages are sharply defined, but the majority blend intricately with each other. In such a comparative study there are presented some of the most interesting problems in vertebrate evolution. For instance, there are here seen such important macroscopic and microscopic differences between man and the higher mammals, especially the anthropoid apes, as to indicate along which lines development has taken place and probably is still in progress. While not emphasizing the importance of the larynx on the characteristic vocalization of the different races of mankind, yet we may note that the anthropologist seeks to find here typical distinctions between various races. Finally, we would assert that through such a study much light may be thrown on many obscure physiologic problems in voice production.

My object in this communication is to draw attention to one or two characteristic features which have recently been forced upon me. It has, within the last year, been my good fortune to be able to study macroscopically and microscopically the larynges of a Chinaman, of an orang-utan, of several macacus monkeys and of a marmoset. I was able to compare these, on the one hand, with the larynges of an adult and infant of the Caucasian race, and on the other, with the larynx of a young lion, as well as with the larynges of some of our common domestic animals, such as the dog, cat and horse.

It would be impossible as well as undesirable to give and discuss here a detailed account of such a study. My desire at this time is to present a preliminary report on some of the more interesting and important findings, and I shall confine my remarks to a comparative study in the anthropoid apes and in man of the ventricles and appendices of the larynx and of the musculature lying directly in relation to the vocal cord, namely, the thyroarytenoid. Finally, I shall discuss some physiologic considerations suggested by these anatomic findings.

In this paper the following classification of the Anthropeidea given by Beddard<sup>1</sup> will be used:

<i>Sub-order.</i>	<i>Family.</i>
Anthropeidea.	{ Hapalidea——Marmoset.
	{ Cebidae.
	{ Cercopithecidae-Macacus.
	{ Simiidae——Simia satyrus (orang-utan).
	{ Hominidae.



It will be noted that in the above examination examples are included from the principal families except the Cebidae.

#### I.—THE VENTRICULUS LARYNGIS AND ITS APPENDIX.

For the purpose of this paper we shall define the ventricle of the larynx and its appendix as follows: The ventriculus laryngis (ventricle of Morgagni) is a pocket-like diverticulum which passes lateralwards between the true and false vocal cords, undermining to a varying degree the false vocal cords; the appendix ventriculi laryngis is a blind sac which projects upwards from the ventriculus.

#### HOMINIDÆ.

In the white race the ventricle communicates by an oval opening with the cavity of the larynx. Its dimensions are very variable; relatively it is much larger in the male than in the female. We may take the figures of Poirier and Charpy<sup>2</sup> as a good average, namely, the length 20 mm. in the male and 13 mm. in the female. The height varies from 4-8 mm. The anterior extremity terminates at each side of the middle line at the angle of the thyroid, immediately beneath the insertion of the epiglottis, by the true and false vocal cords uniting, or ending slightly apart from each other, and by the floor of the ventricle passing imperceptibly into the laryngeal cavity. In the larynges I examined for comparison the floor of the ventricle was horizontal, with little or no sign of a depression or downward slope behind the true vocal cord. The lateral wall is furthest from the vocal cord in the middle or slightly nearer the arytenoid end. Anteriorly this lateral depth gradually decreases and passes medialward into the wall of the larynx. Posteriorly it ends at the border of the arytenoid without dipping either behind it or the processus vocalis.

The appendix in the white races arises by an open mouth 6-8 mm. long, lying chiefly anterior to the middle point of the larynx. It is usually described as passing into the aryteno-epiglottic fold, but it would be better to say that it passes between the arytenoepiglottic fold and the thyroid cartilage. Its height is very variable, not only in individuals of the same race, but even in the same individual. Usually it runs up about 1 cm. and terminates just below the level of the upper border of the thyroid cartilage. I have occasionally seen it

reach to the level of the hyoid, and on one or two occasions to the base of the tongue. Occasionally it may be wanting on one or both sides. Its loose walls lying in folds contain glands and lymphoid tissue. A considerable amount of muscle tissue lies around the ventricle.

The most interesting anomalies found in connection with the ventricle and its appendix in the white man are:

1. A depression in the middle line anteriorly connected with each ventricle and constituting the central fossa of Merckel. The fossa in the case described by Broesicke<sup>3</sup> had penetrated the cartilaginous plate and formed a median ventriculus laryngis.

2. Abnormal size of the appendix. Such examples would include not only the abnormally large intralaryngeal appendices, but in addition those rarer lateral extralaryngeal sacs which pierced the hyothyroid membrane, examples of which have been described by Gruber<sup>4</sup> (Fig. 7) and by Sclavunos.<sup>5</sup> (Fig. 8.)

#### CHINAMAN.\*

The Chinaman appeared to have been about thirty-five years of age. He was tall and well developed. From external appearances it was supposed that he was a native of Northern China. The cadaver had been injected with preserving fluid and had been for some months in a cold chamber previous to dissection. This had produced considerable shrinkage in the soft tissues; otherwise the larynx was in a good state of preservation.

The larynx, compared with a male of the white race of approximately the same age, was conspicuously smaller. The dimension measured transversely across from the middle of the cricothyroid membrane was 18 mm. as compared with 21 mm. in the white. The rima glottidis was 21 mm. as compared with 25 mm. in the white male and 25-30 mm. given by Nicolas.<sup>6</sup> There is a well-marked philtrum ventriculi (Merckel). The ventricle communicated with the larynx by a wide oval space, whose length was 15 mm. and breadth 6 mm. This was compared with a small larynx of a white man of about the same age, which was found to be 21 mm. by 8 mm.

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\*I can find no description of the larynx of a Chinaman in the literature; this appears to be the first one described. A full description will be published later.

The average given by Nicolas is 20 mm. As a result there is here a large respiratory space. The true vocal cords were separated from the false cords anteriorly by a well-marked horizontal depression, which extended across the middle line as a distinct narrow sulcus or canal of 1 mm. in depth. The floor of the sinus is horizontal, except that posteriorly it inclines downwards and lateralwards and is deepest posteriorly; here the ventricle passed behind the arytenoid cartilage, forming a considerable pocket 2 mm. deep posterior, lateral and inferior to the processus vocalis.

The appendix opens by an oval mouth 3.5 mm. long on right side, slightly larger on the left. This opening lies exactly in the middle line. A probe could be passed into the appendix for a distance of 10 mm. on both sides.

The characteristic features of the ventricle were:

- (1) pouch behind arytenoid,
- (2) anterior sinus,

both of which are Simian characters.

#### ORANG-UTAN.

The orang was a well developed female of 18-20 months, which died of bronchopneumonia.

The ventricle is connected with the larynx by a mere chink between the true and false vocal cords. From this opening the ventricular cavity extends downwards behind the true vocal cords for a distance of 8.5 mm., then curves upward on to the lateral wall, which is 4.5 mm. distant from the tip of the true vocal cord. The medial wall anteriorly undermines the false vocal cord to a height of 0.5 mm. Anteriorly the true and false vocal cords do not unite, but their edges come into close apposition. The ventricles of the larynx are here connected by a well-defined canal, 1.5 mm. in depth and almost circular. This canal is formed by the union of the true and of the false vocal cord of one side with corresponding cords of the opposite side. Owing to the close apposition of the edges of the true and false vocal cords, the canal comes most clearly into view when the larynx has been opened in the middle line posteriorly or when the thyroid has been divided in the middle line anteriorly. Posteriorly the true and false vocal cords meet and form an uninterrupted membrane extending over the posterior part of the ventricle. Below the membrane the ven-



tricles extend for a distance of 6.5 mm. behind and below the arytenoid.

The laryngeal appendix communicates with the ventricle by an oval mouth in the middle of the roof of the ventricle measuring 3.5 mm. in length. It consists of an intralaryngeal part and an extralaryngeal part often called the laryngeal sac. The intralaryngeal part of the sac is a short canal with collapsible walls.

The extralaryngeal sac communicates with the intralaryngeal sac by a slightly dilatable opening 6 mm. by 2.5 mm. (Fig. 6.) The long axis of this oval corresponds with and lies adjacent to the inner surface of the thyroid cartilage, the anterior end of this oval lies within 6 mm. of the middle line of the thyroid, and the whole opening of the extralaryngeal sac lies more anterior than posterior. A probe can be easily passed from the ventricle upwards and outwards into the extralaryngeal sac. It is then seen that the canal pierces the thyrohyoid membrane lateral to m. thyrohyoideus, and opens into a soft, loose-walled cavity, whose walls are thrown into numerous folds. The extralaryngeal sac was only covered by skin and platysma muscle. On account of the accidental removal of part of the sac on each side during the post-mortem examination it was impossible to estimate its full dimensions; but it appeared to correspond in form and in size to the sac figured by E. Mayer.<sup>7</sup>

The most distinctive features of the ventricle and its appendages are:

- (1) Their union across the middle line anteriorly.
- (2) The pouch-like cavity posteriorly behind the arytenoid.
- (3) The extralaryngeal sacs.

#### MACACUS RHEBUS.

In a large Rhesus monkey, the anteroposterior diameter of whose larynx from the middle of the cricoid was 13 mm., the entrance to the ventricle is a mere slit. The length of the true vocal cord is 7 mm. Near the tip of the processus vocalis the true and false cords come together and form a membranous band 1.5 mm. in extent to the border of the arytenoid. This aids in forming the posterior recess of the ventricle which passes behind the arytenoid for a distance of 2.5 mm. The floor of the ventricle is almost level with the edge of the true



vocal cord, and the false vocal cord is only slightly, if at all, excavated, except where the appendix comes off. Anteriorly the true and false vocal cords approximate near the middle line. No canal or sulcus exists as in the orang; on the other hand, the cords of each side are separated by a vertical median furrow which passes up into the entrance of the median sac, so that a probe passed from below up the furrow passes into the sac.

The appendix passes 6 mm. beyond the tip of the false vocal cord.

The median or third sac comes immediately into view when the thyrohyoid muscles are lifted. It is a large flaccid walled sac, which fits into the excavated body of the hyoid above and lies below in the notch of the thyroid cartilage, to the upper border of which it is firmly fixed. It can be easily detached from the hyoid. It communicates with the larynx by a short canal opening, as above described, at the angle formed by the insertion of the epiglottis on the thyroid cartilage—an angle in this case of 120 degrees.

#### MARMOSSET.

The aperture between the true and false vocal cords is a mere slit. The ventricle extends anteriorly to within 0.5 mm. of the middle line. No transverse sulcus connects them; on the other hand, as in the Rhesus, they are separated by a median longitudinal gutter. At the upper part of the median gutter lies a marked depression suggesting the opening of a median sac—but no trace of any sac can be seen on careful dissection. Above this depression the epiglottis springs forward at an angle of about 160 degrees. A probe passed up from the ventricle into the appendix reaches into a small cavity in the hyoid near the middle line. The body of the hyoid is expanded, being 1 cm. broad in the middle line, and indicates the position where both appendices meet together though they do not fuse.

In microscopic section the walls of the ventricle are seen to have many folds. The appendix is found to a great extent surrounded by cartilage; one might say that it lies in a cartilaginous cavity. Attached to the wall of this cartilaginous cavity are numerous bands of dense fibrous tissue, which disperse themselves in the elastic and connective tissue around the appendix; but no muscular tissue is seen.

## II.—THE RELATION OF THE M. THYREOARYTAENOIDEUS TO THE VOCAL CORD.

There is one muscle which, from its anatomic position, seems admirably located for the production of various modifications of sound, and to which one looks for some explanation of the diverse qualities of sound, namely, the m. thyreoarytaenoideus. A comparative study shows that this muscle presents marked differences in its relation to the vibratory mechanism in the different families of the Anthropoidea. Also great individual variations are observable, not only among the races of man, but even in our own species. In each case the muscle was examined both in gross dissection and in coronal serial sections.

## MARMOSET.

In this animal the true vocal cord projects as a triangular prismatic mass above the level of the ventricular floor, with base below and apex above. Its dense connective tissue contains elastic fibers and glands, but no muscles. The thyroarytenoid muscle lies some distance below the cord, and is seen as one complete mass, which passes uninterruptedly from its thyroid origin to its arytenoid insertion. It lies close to the fibrous tissue, but at a considerable distance from the ligamentum vocale; no fibers are seen breaking off to enter the fibrous tissue; no fibers pass from it around the ventricle or appendix. (Fig. 1.)

## MACACUS.

The true vocal cord is a blunt projection with thickened fibroelastic tissue. The fibers of the thyroarytenoid are separated from it by loose connective tissue. This muscle extends as one mass across from thyroid to arytenoid, and rises only slightly above the floor of the ventricle; it does not show any separate muscle bands extending into the ligamentum vocale. No muscle tissue is seen in the false vocal cord. In the false vocal cord lies a mass of cartilage; imbedded in the loose connective tissue of the false vocal cord are several bundles of dense connective tissue, in which lie strands of elastic fibers. (Fig. 2.)

## SIMIA SATYRUS.

In the orang the muscle tissue lies well beneath and does not enter into the triangular prismatic mass which forms the vocal

cords. The thyroarytenoid is to be regarded as a compact muscle passing uninterruptedly from thyroid cartilage to arytenoid. The fibrous tissue which surrounds the muscle is, however, in closer relation to the elastic membrane than in the macacus. In some of the microscopic sections there appear strands of muscle fibers which enter between the fibers of the ligamentum vocale. These appear as distinct and separate muscle bands and suggest the distinct muscle bands which form so characteristic an appearance in the true vocal cord of man. (Fig. 3.)

## HOMINIDAE.

In the white races the main structure of the muscle is generally recognized. It takes origin from the middle line of the thyroid cartilage, from the cricothyroid membrane, receiving a few fibers from the upper margin of the cricoid cartilage, where its lower border is in contact with the m. cricoarytaenoideus lateralis. Its fibers sweep up and back and have an insertion into the anterolateral face of the arytenoid, its external border and muscular process, and into the point and inferior face of the processus vocalis. A number of the upper fibers reach the arytenoepiglottic fold and the epiglottis, constituting the m. thyreoepiglotticus.

For descriptive purposes the muscle is divided into two great but purely artificial divisions, namely, (1) m. thyreoarytaenoideus externus—the broad lateral band which sweeps above the level of the true vocal cord and lies in relation to the sinus and appendix, and of which the m. thyreoepiglotticus forms a part; (2) m. thyreoarytaenoideus internus, or m. vocalis, a triangular prismatic mass whose medial surface lies adjacent to the ligamentum vocale and the conus elasticus, and which constitutes a considerable part of the vocal cord.

There is no laryngeal muscle about which there has been so much dispute as the m. vocalis, especially in regard to its relation to the ligamentum vocale. A direct insertion into the ligamentum vocale is accepted among others by Ludwig, Kolliker and Henle; and denied by Luschka, Meyer and Kanthack. At present the question is still an open one. But all are agreed in regard to the intimate relation of the m. vocalis to the cord.

An excellent review of the literature well up to date is given by Lewis.<sup>8</sup> He describes the fibers of the m. vocalis as pass-



ing in between the elastic fibers of the ligament and surrounded by them; but he never finds transition of muscle fibers into elastic fibers. The muscle fibers thus closely related to the elastic tissue of the ligamentum vocale may, he considers, by contracting, make tense the vocal ligament. Moreover, fibers of the ligamentum vocale are reinforced by additional fibers from the perimysium of the m. vocalis, and in this way the cord may be rendered tense. He suggests that these reinforcing fibers may act as follows: Where the arytenoid is adducted, these fibers will abduct the cord and render it tense.

#### CHINAMAN.

The muscle thyroarytenoid projects into the true vocal cord and forms a well-marked m. vocalis, which, however, cannot be separated from the m. thyroarytaenoideus (externus). The superior and medial fibers of the m. vocalis, especially near the arytenoid end, insinuate themselves well within the fibrous and elastic tissue of the true vocal cord. Some of these bands are relatively small, consisting of six to ten muscle fibers; others contain three or four times that number. The fate of these individual bands is hard to determine; they ultimately diminish in number and in size, and disappear in the tissue of the cord.

It was found impossible to compare accurately the relative size and relation to the ligamentum vocale of the m. vocalis in the white man and Chinaman. The different conditions under which the tissue had been fixed and preserved had altered the parts considerably. Still, it appeared that in this Chinese larynx the m. vocalis was farther away from the apex of the true vocal cord, and that the muscle near the apex was more split into sections by the fibrous tissue. (Fig. 5.)

#### FUNCTIONS OF THE LARYNGEAL SACS.

Very varied are the opinions held in regard to the function of the appendices of the larynx, and we will not go far astray if we say that at present their physiologic action is unknown. It is interesting to note the different opinions that have been put forward:

(1) It has been very generally held that they act as resonators. This seems to hold in regard to the median sac of *Mycetes*, the howling monkeys, and to the varieties of Ma-



cacus which I have examined. In these animals the nature of the sac and its relation to the cavity in the hyoid seem adapted to act as a resonator. In addition the mouth of the sac, lying in the middle line at the obtuse epiglottic laryngeal angle, gives further emphasis to this view. It is generally believed that the peculiar piercing cry of the howling monkey is due to this. But in the higher apes with soft sacs, with walls often extending to the clavicle and normally in apposition, it is not possible for them to act as resonators under ordinary conditions.

(2) Fraenkel<sup>9</sup> has suggested that in man one purpose is to pour secretion on the vocal cords, and so to keep them moist. However applicable this function may be in the white man with a horizontal floor, I can see very serious objections to the general application of such an hypothesis. I doubt its adequacy in the Chinaman I have just described, in the negro larynx as described by Gibbs, or in the apes. In these the floor often sinks below the level of the true vocal cord, and it appears to me the secretion would collect in the sulcus lateral to the cord. Moreover, in the apes the glands approximate so closely to the apex of the cord as to render such a secretion unnecessary.

(3) Vrolick<sup>10</sup> has suggested that the extralaryngeal sacs in the apes lighten the upper part of the body in climbing. An allied suggestion is that as the head of the ape is relatively heavy, we have it placed, as it were, on an air cushion, which takes a good deal of weight off the trunk and allows the animal to assume an erect position. Even were these suggestions suitable, their limitations to a few species would be detrimental to their general applicability.

(4) Deniker<sup>11</sup> believes that the extralaryngeal sacs act as a protection for the vessels of the neck in the apes. He points out that the heavy face bones increase the pressure forward and so are apt to produce constriction of the cervical vessels.

Interesting as these suggestions may be, their applicability to only a few species seems to call for a general principle on which to base an hypothesis capable of explaining the presence of these widely distributed diverticula. It has always appeared to me that if any general principle underlies their presence and variable development, one must seek for such along the line of the general development of the larynx. Now, con-

fining my attention chiefly to the anthropoidea as I have done in this paper, I believe that the general development of the larynx has been progressive along the lines and to satisfy the demands of interrelational life. If this be so, we ought to look in this principle for some explanation of the significance of these sacs.

Every one recognizes that the cry of the animal is greatly modified by its emotional states. I would suggest that in emotional stress these inert sacs can be called into play, can be distended and modified in form; so there can be given to the vocal emission a tone of peculiar and significant intensity. In making this suggestion I do not forget the important role which may be played under such condition by the mouth, nose and nasopharynx. But I do believe that we have here, in the immediate neighborhood of the cords, structures which may undergo modifications most suitable for this purpose. I would suggest that in the laryngeal sacs we have analogous structures for analogous purposes to the esophageal sacs of birds such as the pigeon, which inflates the throat and crop when cooing to a mate or neighbor. To elaborate this suggestion would take one far beyond the limits of this paper. I, therefore, confine myself to two examples in the anthropoid apes, which will exemplify my contention. The monkeys I have chosen are one from a New World family, Cebidea, and one from an Old World family, Simiidae. These two families are not only "absolutely distinct at the present day, but they have been, so far as we know, for a very long time, since no fossil remains of monkeys at all intermediate have been so far discovered." (Beddard.<sup>12</sup>)

(1) It appears to me that there is sufficient evidence to show that the characteristic cry of the *Mycetes*, the howling monkey (family *Cebidae*), is not intended to frighten his enemies, as is generally stated, but is used to modify the voice in order to express mental states and emotions.

Professor Tower of the Chicago University Biological Department, has kindly furnished me with some notes in regard to the howling monkey, the results of his observations of them in the forests of Central America. Since so few statements by competent observers are in the literature, and since Professor Tower's observations are not only of great interest, but so opposed to the usual statements in our text-books, I have

dwelt on this more fully than is requisite for my particular purpose.

In the forest the monkey begins to howl about four in the morning, sometimes earlier, depending on whether the night is very warm or very cold, or if there is a bright moon. Usually it is an old male who starts when the forest is very still. He is answered from different directions by a second, a third or a fourth; very rarely two are howling at the same spot. So they cry backward and forward till about seven in the morning, when the feeding activities of the day begin. The cry is not heard as a rule very long after sunrise. In the cool of the evening the howling is resumed. The cry is guttural, not a shriek; it is like that of a man being throttled. It is not always the same note; the sounds emitted vary in range, in pitch and in individuality. This individuality is very marked. A monkey may utter six or seven sounds of different pitch, the whole lasting about thirty seconds and then being repeated. The others answer, each one varying these sounds.

The howling is most marked during the breeding seasons. The chief breeding season is in June, the young are born in December. The next or minor breeding season is in January. But breeding is not confined altogether to these two seasons, but is more generally diffused than in the lower mammals and approximates to man.

The attitude of the monkey when he howls is very characteristic; he raises himself up, fixes his arm on the limb of a tree, raises his head and howls. In other words, he appears to be fixing his extrathoracic muscles. A gunshot will at any time stop the howl. It is very doubtful if the cry is heard at more than half a mile. Experience in hunting shows that one can usually locate the howler within a quarter of a mile. Of course, a good deal will depend on the wind. Again, when one has been hunting in the forest the ear gets attuned to the forest so that any disturbance, even at a great distance, is felt rather than heard. So although one may not recognize the sound as a howl, still one may recognize a disturbing element in the air and education and experience does the rest.

(2) Our present evidence seems to point to the conclusion that the extralaryngeal sacs of the *Simia satyrus*, orang-utan (family Simiidae) are but rarely distended, and then only under emotional stress. The sacs are never distended during



forced expiration. There are few direct and careful observations which have been published in regard to the distension of these sacs, but these support the statement that in captivity the extralaryngeal diverticula are seldom distended, and then only in emotional states. The following interesting observations are given by Meyer<sup>13</sup> in regard to the orang Rolff in the zoological gardens in Berlin: "Unser Rolff blähte sich auf wenn er sich argerte und denjenigen schrecken wolte, welcher ihm Missvergnügen bereitete." In strong expiratory actions such as blowing up a fire, the extralaryngeal sacs were never distended.

#### THE LARYNGOCELE AND EXTRALARYNGEAL SAC.

Connected with the varying size of the appendix is the question of the origin of the laryngocele and the lateral extralaryngeal sacs in man. Are they pathologic or are they a phylogenetic reversion? As is well known, the laryngocele is an enlargement of the appendix which projects beyond the normal limits of this diverticulum, for example into the sinus pyriformis or above the hyoid into the glossoepiglottic fossa. The extralaryngeal sac is an enlargement of the appendix which projects through the thyrohyoid membrane lateral to the thyrohyoid muscle and lies under the platysma muscle. Of these the two classical examples in man are the double sac described by Gruber<sup>4</sup> (Fig. 7) and the single sac described by Sclavunos.<sup>5</sup> (Fig. 8.)

There appears to be sufficient evidence to suggest that certain enlargements of the appendix are pathologic, *e. g.*, the presence of a tumor blocking the aditus laryngis causing the dilatation of the ventricle. Included in this class must be the cases quoted by Larrey of the prevalence of laryngocele among those blind Mohammedans who are employed to chant verses of the Koran every hour of the day and night. But can one with Hanseman<sup>14</sup> dismiss the subject with the general statement that all are Missbildungen, to be classed with hernia, due to a congenital or acquired weakening of thyrohyoid membrane and as a consequence dilatation subsequent to respiration. I would here remind you that *post hoc* is not necessarily *propter hoc*, and, further, that such dilatations are not always accompanied by pathologic lesions or with a history comparable to that given by Larrey. I would ask you to consider that the



close analogy these sacs have to those found in the primates, for example in the orang, suggests that they may be phylogenetic reversions. In this connection let me remind you that in the orang and gorilla the extralaryngeal sacs are not present at birth; they are appendages which begin to appear in the early months of extrauterine life.

In addition ontogeny throws some light on this question. It has been brought out by a study of the fetal larynx, especially by Sclavunos<sup>15</sup> and Bartel,<sup>16</sup> that appendices are there always present, are always well developed and arise from the whole ventricular roof. In a large proportion they pass far above the upper border of the thyroid, even to the root of the tongue. In one case quoted by Sclavunos the dilatation occupied not only the glossoepiglottic fossa, but the greater part of the sinus pyriformis. Normally a diminution occurs in extrauterine life. There would, therefore, appear to be some justification for regarding them as a persistence of the fetal conditions, and this would at once strengthen the hypothesis that some, at any rate, must be regarded as phylogenetic reversions. It is interesting here to note that the first case quoted of a "laryngocele" was in a deaf mute of forty years of age, which Rudinger, who described it, believed to be a case of phylogenetic reversion. As Bartels says, it is difficult to understand how the inarticulate cry of a deaf mute could produce a laryngocele.

#### M. THYREOARYTAENOIDEUS.

In a comparative study of the musculature directly related to the cord, the outstanding facts appear to me to be a gradually increasing complexity of the m. thyreoarytaenoideus and a closer approximation of it to the ligamentum vocale. The internal part of the muscle gradually enters into closer relation to the cord, finally becomes incorporated with it, and in man sends distinctly separated bundles into its fibroelastic tissue which constitute the m. vocalis. In the marmoset and macacus the m. thyreoarytaenoideus is one compact muscle bundle lying apart from the vocal cord and not incorporated in it. In the orang this muscle approaches closer to the cord and a few muscle bands are separated off and partly embedded in it. This is in complete agreement with Giacomini,<sup>17</sup> who has shown that in the gibbon and chimpanzee this incorporation has advanced even farther and there begins

more distinctly to be seen that characteristic appearance so distinctive of the *musculus vocalis* of man. When one studies the walls of the ventricle, there is noted in the marmoset no muscle tissue around the ventricle. In the orang muscle fibers pass around the interlaryngeal portion of the ventricle. In man they are distinctly seen, but apparently varying in amount in different individuals, and it may be in different races, for in my Chinese larynx they are less abundant than in the white man of the corresponding age.

These facts suggest a function directly related to the true vocal cord and to its physiologic activity. They show the development of a mechanism by which a finer or more exact control of the vocal apparatus can be obtained. This incorporation of the muscle in the cord will bring the activities of the cord directly under the control of the nervous system. If it be that the sacs can be used to vary the voice in states of emotion, how much more exact, how much more capable of development will such a muscular mechanism be?

From a comparative study of the larynx one fact appears to me clearly to stand out, namely, that we have here an organ whose recent phylogenetic history shows marked developmental progress and whose present state is that of great variability. The latter fact would itself suggest developmental activity. In this activity I feel that we do not realize as fully as we ought the important part which has been played and is still being played by the psychic state. We constantly recognize the important relation of sex to the vocal organs; but is not this but one aspect of the role played by the emotions? Is it not the case that mere words can never convey to us that finer expression of the emotions with which the voice can thrill us? And if this be so, must not this inevitably tend to further development of the larynx? In taste and in smell, and it may be in the eyes, we have a marked restriction of the peripheral distribution of the respective fields; but in voice, with its natural ally, speech, we have an expansion of the territory which is being utilized. Here the progress is markedly forward and it may be that we shall yet be able to demonstrate subtle anatomic differences comparable to the higher physiologic functions which it manifests in man.

In the preparing and examining of specimens necessary for this paper, I have been ably assisted by one of my students, Miss Jeanette Obenchain.

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## EXPLANATION OF FIGURES 1, 2, 3, 4 AND 5.

Figures 1 to 5 were drawn from microscopic sections, and figure 6 from a prepared specimen, by Miss Hill of the Department of Anatomy, University of Chicago. Figures 7 and 8 are photographs of plates from the works quoted.

These figures are from sections at middle third of true vocal cord near arytenoid end, showing the relation of m. thyreoarytenoideus to vocal cord. (Zeiss comp. occ. 4, obj. A2 outlined with camera lucida.)

- p. v. .... plica vocalis (true vocal cord).
- p. ventr. .... plica ventricularis (false vocal cord).
- v. l. .... ventriculus laryngis (Morgagnii).
- a. v. l. .... appendix ventriculi laryngis.
- m. ta. .... m. thyreoarytenoideus.
- m. v. .... m. vocalis.
- g. .... glands.
- c. .... cartilage.

Figure 1.—Marmoset (family Hapalidae).

Figure 2.—Macacus Rhesus (family Cercopithecidae). b—thickened fibroelastic tissue external to muscle with loose tissue superior to it.

Figure 3.—Young orang-utan, *Simia satyrus* (family Simiidae). f—muscle fibers separating off from m. thyreoarytenoideus and entering tissue of true vocal cord.

Figure 4.—Hominidae—white man.

Figure 5.—Hominidae—Chinaman. Section of true and false vocal cord with ventricle. (Zeiss comp. occ. 2, obj. A2, outlined with camera lucida.)

Figure 6.—Communication between extra- and intralaryngeal sacs of young *Simia satyrus*, orang-utang. Whole of left extralaryngeal sac cut away: part of right sac attached to deeper structures is seen extending slightly to left of middle line.

C and C'—openings in thyrohyoid membrane between extra- and intralaryngeal sacs of right and left side.

S—part of right sac attached on its deeper surface.

M—thyrohyoid membrane.

H—body of hyoid bone.

I. H. M.—infrahyoid muscles.

S. H. M.—suprahyoid muscles.

T. R.—first tracheal ring.

Figure 7.—Lateral extralaryngeal sacs in man reproduced from "Ueber einen Kehlkopf des Menschen mit theilweise ausserhalb desselben gelagerten seitlichen Ventrikelsacken," by Dr. Wentzel Gruber (Archiv f. Anat. Physiol. u. wissenschaft. Medicin., 1874, p. 604, Taf. XV, Fig. 2).

Y and Y'—right and left extra-laryngeal sacs.

A—cartilago thyroidea.

B—cartilago cricoidea.

2—corpus ossis hyoidei.

6—glandula thyroidea.

a—ligamentum hyo-thyreoideum medium.

f—m. sternohyoideus (turned upwards).

g—m. omo hyoideus (turned upwards).

h—m. hyothyroidus.

k—m. cricothyroideus.

s.—n. laryngeus superior.

t—art. laryngea superior.

Figure 8.—Extra-laryngeal sac in man from Slavunos—reproduced from W. L. H. Duckworth's *Morphology and Anthropology*. University Press, Cambridge, England, 1904.





FIGURE 1.





FIGURE 2.







FIGURE 3.





FIGURE 4.







FIGURE 5.



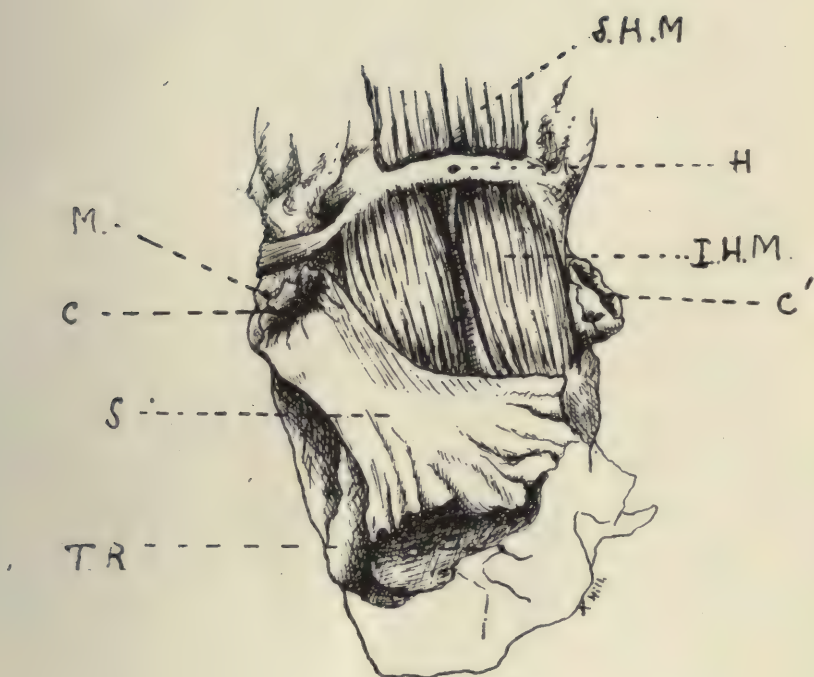


FIGURE 6.







FIGURE 7

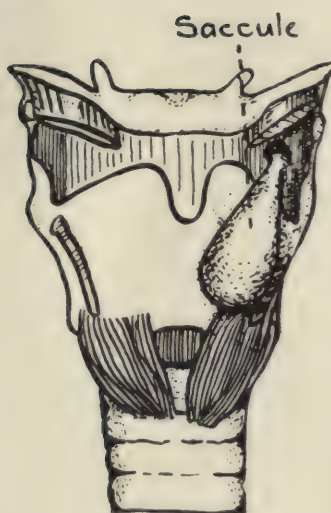
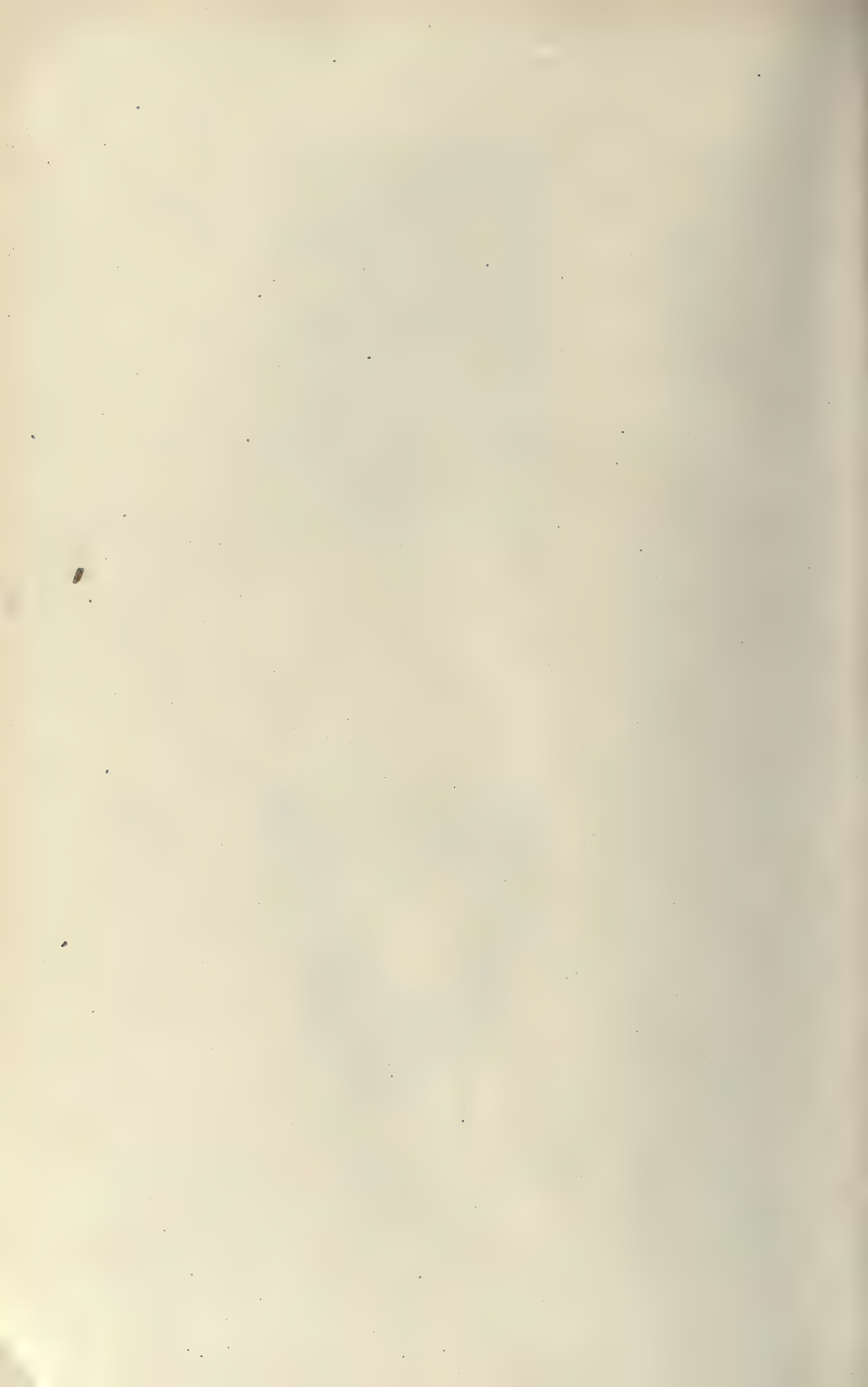


FIGURE 8



## LVIII.

### THE PHYSIOLOGY OF TONE PERCEPTION.

BY GEORGE E. SHAMBAUGH, M. D.,

CHICAGO.

#### PART I.

A discussion of the modern theories of sound perception begins naturally with a consideration of the work of Helmholtz. The theories of sound perception that had found expression for several centuries preceding the time of Helmholtz embodied, however, the fundamental conceptions of the Helmholtz theory, to-wit: that tone perception is dependent on the vibration of structures in the cochlea in response to the impulses of sound waves, and, second, that this response takes place in different parts of the cochlea for the tones of varying pitch. It was the work of Helmholtz to elaborate these ideas and to give them their greatest scientific support.

My own interest in the question was aroused by the finding of certain anatomic conditions which convinced me that the basilar membrane theory of Helmholtz is untenable. My studies in the anatomy of the labyrinth convinced me also that from anatomic data alone we are able to determine at least the probable role of the several structures in the cochlea which take part in the perception of sound, and that we are in this way able to establish a fundamental anatomic basis for the further study of the problem.

The reaction in the cochlea which results in the transference of sound waves to nerve impulses is apparently a physical one. For this reason the questions involved in the problem of sound perception are peculiarly dependent for their solution upon an accurate knowledge of the structures in the labyrinth. An investigation of the anatomy of these structures should form, therefore, the basis for the study of this problem. This seems all the more important since the subject is one that can be approached only indirectly and does not permit of actual demonstration. Most of the work on the problem of sound perception has been approached, however, from the stand-

point of the physiologist and of the psychologist. Relatively little use has been made of the assistance offered by anatomic study in the efforts to solve the problem. Theories have been worked out independent largely of anatomic considerations, and then an effort made to fit them to anatomic conditions. In this way fundamental errors have arisen which could scarcely have occurred had the problem been approached from the standpoint of the anatomist.\*

A conspicuous feature in the anatomy of the inner ear is the close structural analogies found to exist between the three types of end organs in the membranous labyrinth; the macula acustica of the utricle and saccule, the crista acustica of the ampullae, and the organ of Corti of the cochlea. These end organs, in addition to a common origin in the primitive otic vesicle, have fundamentally the same histologic structure. Each end organ consists of hair-bearing cells and of a peculiar superimposed structure of epithelial origin. This latter structure in the cochlea is the membrana tectoria. In the macula acustica it is the otolith membrane, and in the crista acustica it is the so-called cupula.

This close structural analogy between these three types of end organs suggests that functionally we may expect to find them reacting to stimuli in much the same manner. The following conclusions regarding the response of the end organs to stimuli seem justified:

1. That the stimulation of all three end organs is a physical one.
2. That the actual structure wherein the transference of a physical to a nervous impulse takes place is the hair cell.
3. That the stimulation of the hair cells in each end organ is brought about by an irritation applied to their projecting hairs.
4. That the irritation of the hairs of the hair cells consists

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\*Helmholtz, for example, first became convinced that the phenomena of subjective tone analysis could be best accounted for on the principle of physical resonance. He then sought to find the structure in the cochlea which could act as resonator and at the same time bring about a stimulation of the hair cells of Corti's organ. The rods of Corti seemed to resemble most a known type of resonator, and Helmholtz believed that in vibrating these rods in some way brought about a stimulation of neighboring groups of hair cells. This theory he discarded later and selected the radiating fibers of the membrana basilaris as the resonators. I believe we are able now to show that this conclusion of Helmholtz was also a mistake.



of an interaction between the hairs and their superimposed membrane, the membrana tectoria, the otolith membrane, and the cupula, respectively.

5. That the interaction between the hairs of the hair cells and this superimposed membrane is brought about in each instance by movements in this membrane.

It is generally conceded that these fundamental principles in the physiology of the end organs of the labyrinth are true for both the macula and the crista acustica. There does not appear to be any reason for believing that they do not hold equally true for the end organ found in the cochlea, the organ of Corti. The theory of tone perception should rest, therefore, on this fundamental proposition, that the stimulation of the hair cells of the organ of Corti consists of an interaction between their projecting hairs and the membrana tectoria, which interaction is brought about by movements in this membrane imparted to it by the impulse of sound waves passing through the endolymph.

This conception of the physiology of the cochlea, placing the active role for the stimulation of the hair cells in the membrana tectoria, is at variance with the generally accepted theory which attributes this function to the membrana basilaris. The origin of the idea that the membrana basilaris takes the active part in bringing about a stimulation of the hair cells of Corti's organ dates practically from the work of Helmholtz. This investigator in studying the phenomena of tone perception was convinced of the idea that subjective tone analysis finds its most plausible explanation in the principle of physical resonance. Helmholtz then inquired of anatomists for a structure in the cochlea which might seem suited to fill the role of a physical resonator. His first conclusion was that the rods of Corti filled this role by acting as a series of rod resonators. When it was shown that in certain animals capable of tone perception these rods were lacking, Helmholtz gave up this conclusion and later fixed upon the radiating fibres of the membrana basilaris as the structures which by responding in the several parts of the cochlea to tones of different pitch brought about a stimulation of different groups of nerve fibres for each tone in the scale.

It is interesting to note how this conclusion of Helmholtz attributing the active role in the stimulation of the hair cells

of the organ of Corti to the membrana basilaris has been accepted by those who have since worked with this problem, even by those who have attempted to substitute for the principle of physical resonance some other mode of action. Ewald,<sup>1</sup> for example, starts with the hypothesis that the stimulation of the hair cells of Corti's organ is dependent on the vibration of the membrana basilaris. He then constructs a model having a stretched rubber membrane representing the membrana basilaris, and by studying the vibration of this rubber membrane when sound waves are conducted into his model, he attempts to determine the manner in which the membrana basilaris itself responds to the impulse of sound waves in the labyrinth. Max Meyer,<sup>2</sup> also, does not accept the principle of physical resonance, but adopts the idea that the membrana basilaris fills the active role and builds up his theory on this hypothesis.

I believe we are justified in asserting that when we attribute the active role in the stimulation of the hair cells in Corti's organ to a structure other than the membrana tectoria, we are beginning our study of tone perception with a fundamental error in the physiology of the cochlea, an error which has found its way, however, into most of the work that has been done on this problem.

A careful scrutiny of the structures in the cochlea disclose, moreover, a number of anatomic conditions which clearly make it impossible for the membrana basilaris to fill the active role attributed to it by Helmholtz and his followers. The radiating fibres of the membrana basilaris apparently do not consist of independent bands, but the fibres are interwoven more in the nature of a flat tendon (Hardesty). These fibres also, though part of the cochlea, are so imbedded between cellular layers above and below that it is not easy to see how they can be acted upon by impulses in the labyrinthine fluids. According to the principle of string resonators we should expect, moreover, to find that as the fibres of the membrana basilaris become shorter toward the lower end of the basal coil, they would also become thinner and more tense. I have found, however, that just the opposite is the case.<sup>3</sup> The membrana basilaris toward the lower end of the cochlea invariably becomes thicker and frequently loses all resemblance to a vibrating structure at a point where a perfectly formed organ of Corti is still found. However serious these objections may

seem, there is another anatomic objection which I believe constitutes an unanswerable argument against any theory which attributes the active role in the stimulation of the hair cells of Corti's organ to the vibration of the *membrana basilaris*. This is the presence of the blood vessel attached throughout the coils of the cochlea to the under surface of this membrane. This blood vessel, I have been able to demonstrate by injection experiments, is capable of the dilatation and contraction which other blood vessels in the body undergo when subjected to varying degrees of blood pressure, etc. It is essential for the Helmholtz theory or for any theory that attributes the active role to the *membrana basilaris* that this structure responds at all times equally to the same impulse. The presence of this blood vessel, subject to varying degrees of distention and contraction, makes such a response a physical impossibility, and renders these theories untenable.

On the other hand, the *membrana tectoria* seems not only to be the logical structure for taking the active part in the stimulation of the hair cells of Corti's organ, but it appears to be admirably suited anatomically to fill this role. Its delicate structure should render it suitable for responding to the slightest impulse passing through the endolymph, and its physical character is such that it must respond unvaryingly at all times to the same impulse.

Before discussing the manner in which the *membrana tectoria* probably responds to impulses of sound waves passing through the endolymph, let us consider for a moment the suggestion made by some that the stimulation of the hair cells of Corti's organ may be accomplished by the hairs receiving stimuli directly from impulses in the endolymph without the intervention of the *membrana tectoria*. Objections to this hypothesis are, first, such a theory would leave the *membrana tectoria* without a plausible function; second, such a mode of response for the hair cells in the organ of Corti would make this end organ functionate in a manner quite different from its analogous structures in the vestibule and semicircular canals, where the stimulation of the hair cells is unquestionably dependent on an interaction between their projecting hairs and the superimposed structures, the otolith membrane and the cupula; third, the relation between the hairs of the hair cells of Corti's organ and the under surface of the *membrana tec-*



toria is such as to make it impossible for these hairs to receive impulses direct from the endolymph, but that these impulses must first pass through the membrana tectoria. This is the sort of relation we should expect to find between the hair cells of Corti's organ and the membrana tectoria, since it is the relation known to exist between the hair cells of the macula acustica, and the crista acustica, and the otolith membrane and cupula, respectively. In my work on the labyrinth of the pig I have been able to demonstrate that in both the newborn and the adult pig this is the normal relation between these hair cells and the membrana tectoria; the hairs are normally in actual contact with this membrane. Kolmar also demonstrated this relation in the labyrinth of the adult pig.<sup>4</sup>

#### PART II.

We may begin then with the fundamental proposition that the stimulation of the hair cells of Corti's organ must be brought about by movements in the membrana tectoria imparted to it by the impulse of sound waves passing through the endolymph. The problem then resolves itself into determining what mode of response in the membrana tectoria will best explain the phenomena, normal and pathologic, associated with sound perception.

The following facts in the anatomy of the membrana tectoria are of importance here: This membrane has a delicate semigelatinous structure, suitable for responding to impulses passing through the endolymph. It is not a homogeneous structure, but is made of an immense number of delicate fibrilli imbedded in a gelatinous matrix. There is decided variation of size in this membrane from one end of the cochlea to the other, being much smaller toward the lower end of the basal coil and becoming gradually larger toward the apex of the cochlea. The membrane does not lie free above the organ of Corti, but is in actual contact with the hairs of the hair cells.

In attempting to determine the probable mode of response of the membrana tectoria to the impulse of sound waves one should keep clearly in mind certain physiologic and pathologic phenomena to be accounted for. The most important of the physiologic phenomena is the faculty which the ear possesses of subjective tone analysis. The complex impulses



which impinge on the organ of hearing when several tones are sounded simultaneously is analyzed subjectively so that we are able to distinguish each of the tones entering into the complex. There are two theories as to where this subjective tone analysis is accomplished. According to one it is accomplished in the peripheral apparatus in the cochlea; according to the other theory, this analysis is a function of the cerebral cortex. The first hypothesis, that of peripheral tone analysis, makes different groups of fibers in the cochlear nerve respond to different tones in the scale. The second hypothesis, that of central tone analysis, assumes that the cochlear nerve trunk responds as a whole to every tone in conveying impulses to the cerebral center. This latter hypothesis is known as the telephone theory of Rutherford and is clearly untenable from the standpoint of the physiologist, as has been shown especially by Ewald<sup>5</sup> and McKendrick<sup>6</sup>. The so-called secondary phenomena of tone perception, such as the phenomena of beats, different tones, etc., receive their only plausible explanation on the hypothesis of a peripheral rather than a central analysis.

Of the pathologic phenomena to be considered in a discussion of this problem, the most important is the occurrence of so-called "tone islands" and of defects in the midst of the tone scale. These phenomena are known to occur only in connection with disease of the labyrinth. It is not uncommon to find in cases of deafness of labyrinthine origin the preservation of circumscribed areas of hearing in the midst of the scale, as well as the occurrence of circumscribed defects in the scale. This well known pathologic phenomena occurring apparently only in connection with disease of the labyrinth, seems to be accounted for plausibly only on the hypothesis that circumscribed areas in the cochlea have to do with the perception of particular tones, that is, on the existence of peripheral tone analysis. Another pathologic phenomenon to be considered in connection with this problem is the production of a circumscribed defect in the tone scale resulting from an injury produced by a shrill whistle of the same pitch. This phenomenon also points to a localization of the perception of the various tones in separate parts of the cochlea, that is, to a peripheral tone analysis. There is still another pathologic phenomenon which has an important bearing on this

problem, that is, the production of circumscribed areas of degeneration in the organ of Corti as the result of overstimulation by tones of a certain pitch. The demonstration of this fact was first made by Wittmach.<sup>7</sup> The work has since been carried on by Yoshii<sup>8</sup> under the direction of Prof. Siebenmann. It is perhaps the nearest approach to an actual demonstration of the theory that the perception of the various tones takes place in separate and distinct parts of the cochlea, a demonstration, in other words, of the theory of peripheral tone analysis. The pathologic phenomenon of "diplacousis" where a patient hears a tone in the affected ear of a pitch different from that heard in the normal ear, seems also to be accounted for plausibly only on the hypothesis of the existence in the cochlea of a structure which vibrates differently in its several parts for different tones; that is, on the existence of peripheral analysis.

Returning now to the problem of determining the probable action of the membrana tectoria when acted upon by the impulse of sound waves in the endolymph, three possible modes of response suggest themselves. By the first the minute impulses caused by the tones highest in the scale would throw into vibration only that part of the membrana tectoria nearest the beginning of the basal coil where this membrane is very small. Each tone lower in the scale would then cause vibrations in a larger and larger extent of this membrane until the lowest tones we perceive would throw this entire structure into vibration. Such a response in the membrana tectoria, it would seem, might account for the phenomena of subjective tone analysis, since for each tone in the scale a different group complex of hair cells is stimulated. A fundamental objection, however, to this hypothesis is that it seems to offer no plausible explanation for such phenomena as "tone islands" or of defects in the midst of the tone scale, nor does it explain how circumscribed degenerations in the organ of Corti in different parts of the cochlea are produced as the result of overstimulation from tones of a certain pitch.

The second possible mode of response in the membrana tectoria to sound waves that suggests itself is that it is thrown into vibration throughout its entire extent by every tone in the scale, the highest as well as the lowest. Physically this might seem to be quite possible. Such a response in the mem-

brana tectoria would result, it seems, in a stimulation of the hair cells of the cochlea in one of two ways; either the vibration in the membrana tectoria throughout its entire extent for every tone would stimulate every hair cell in the cochlea for each tone in the scale, or the hair cells of the cochlea might be stimulated in different groups for each tone, just as they would be in the Ewald theory, by the vibration of the membrana basilaris. According to this last method, the undulations of the membrana tectoria would cause a stimulation only of those hair cells opposite the crests of the waves. In this way different groups of hair cells might be stimulated for each tone in the scale. The first hypothesis, that all the hair cells in the cochlea are stimulated for each tone in the scale, is but a restatement of the principle of the telephone theory, of Rutherford, an untenable hypothesis.<sup>9</sup> Fundamental objections to the second hypothesis that different groups of hair cells scattered throughout the cochlea are stimulated for each tone in the scale as in the Ewald theory are:—

1. Such a theory fails to account for the existence of "tone islands" or defects in the tone scale, nor does it explain the occurrence of circumscribed degenerations in the organ of Corti as a result of overstimulation by certain tones.

2. There appears to be a fundamental anatomic objection to such an hypothesis since the normal relation between the hairs of the hair cells and the membrana tectoria, one of actual contact, would appear to make it impossible for vibrations in the entire extent of this membrane to fail to stimulate all the hair cells throughout the cochlea. Such an action, as pointed out above, brings us again to the basis of the untenable telephone theory.

The third possible mode of response of the membrana tectoria to sound waves is that circumscribed areas in this membrane are thrown into vibration in different parts of the cochlea for tones of varying pitch. The tones highest in the scale would then produce vibrations in the tiny tectorial membrane found near the beginning of the basal coil, whereas the tones lower in the scale would produce response only in the larger tectorial membrane found in the upper coils of the cochlea. Circumscribed groups of hair cells in different parts of the cochlea would then be stimulated for each tone in the scale. This hypothesis accounts readily not only for the phenomena



of subjective tone analysis, but it offers the only plausible explanation for the occurrence of "tone islands" and of defects in the midst of the tone scale, as well as for the production of circumscribed areas of atrophy in the organ of Corti as the result of overstimulation by tones of a definite pitch.

The following conclusions, therefore, seem quite clear: First, that the membrana tectoria is the structure in the cochlea which by responding to the impulse of sound waves in the endolymph, brings about a stimulation of the hair cells of Corti's organ; second, that circumscribed areas in this membrane respond in different parts of the cochlea for tones of varying pitch, the high tones in the basil coil, the lower tones in the upper coils of the cochlea.

Such a response in the several parts of the membrana tectoria to the various tones in the scale is best accounted for, it seems, by the principle of physical resonance. The varying size of this membrane from one end of the cochlea to the other, and its complex fibrillar structure, are physical factors which suggest the basis for such a response. The actual demonstration by the construction of a model seems to be out of the question in a structure as delicate and as complicated as the membrana tectoria, especially since we are as yet unable to state what are the exact physical properties of this delicate structure. The fact that the explanation of the stimulation of the end organ in the cochlea is in the nature of an hypothesis that eludes actual demonstration, does not make the organ of Corti differ in this respect from other special sense organs. To expect of the physicist that he shall actually demonstrate just how the membrana tectoria fills the role of physical resonator is probably asking too much. It scarcely seems probable that the physicist with our present knowledge will be able to add anything that is much more tangible in the discussion of the problem of tone perception than has the chemist in the problem of color perception, nor should we expect that attempts to apply exact mathematics and physics in the explanation of the vibrations of the membrana tectoria would lead to any very profitable conclusions, at least until we are able to determine the exact physical character of this membrane. On the other hand, it should be recognized that the inability of the physicist to furnish us with an actual demonstration of the action of the membrana tectoria can hardly be construed as an



argument against the conclusions to which a logical discussion of this problem leads, namely, that circumscribed areas of the membrana tectoria respond in the several parts of the cochlea to tones of varying pitch, such a response being most readily accounted for, it seems, on the principle of physical resonance.

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## LIX.

### THE PRESENT STATUS OF LABYRINTHINE SURGERY.\*

By S. J. KOPETZKY, M. D.,

NEW YORK.

Since 1895, when Jansen<sup>1</sup> first suggested the operative opening into the labyrinth to combat its purulent invasion, a great number of observations have accumulated, and many modifications of the operation on the labyrinth have been advocated. To Jansen, who led the way in surgical technic, and to Barany, who developed means of diagnosis, the profession is greatly indebted for whatever light has already been shed on this, the most obscure, insidious and baffling of all the complications of middle ear suppuration.

I intend avoiding more than a casual reference to the immense literature of this subject. Mostly recent, it is easily available, and I forbear the time and space which a thoroughly critical review of this side of the subject would entail. Personal observation necessarily must be of more interest, and in the hope of eliciting the experience of others with labyrinthitis, I present the present status of labyrinthine surgery from the personal standpoint.

To appreciate the basis of my remarks and comments, a very brief summary of my cases becomes necessary.

#### CASES.

CASE I. Female, 27 years of age, came under observation (Manhattan Eye and Ear Hospital) August, 1906, suffering with an acute exacerbation of a chronic middle ear suppuration. Radical operation performed August 20, 1906.

August 22, 1906. Nausea, vomiting and rise of temperature, besides a feeling as if falling forward, accompanied by dizziness, are noted.

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\*Read at the fifteenth annual meeting of the American Academy of Ophthalmology and Oto-Laryngology, Cincinnati, September 19, 1910.

August 23. General condition better, but nervous irritability increased.

August 25. Horizontal nystagmus when eyes are turned toward healthy side, and later in the day, in addition, vertical nystagmus. P. 90, R. 22, T. 100.

Immediate exploratory operation. No fistula found, no erosion on semicirculars found.

At tip of petrosal pyramid, pus located communicating with an intradural abscess.

Patient grew rapidly worse and died 3½ hours after exploratory operation.

NOTE: Although there were symptoms from labyrinth, no external evidence on labyrinth wall was present to demonstrate that this was diseased.

CASE II. J. M., one year of age, came under observation at the Manhattan Eye and Ear Hospital March 27, 1907. Has otorrhea of three months' duration. Facial paralysis came on simultaneously with the otorrhea. Patient brought in semicomatose. Immediate radical mastoid operation, among the findings of which were necrosis of the dura; posterior bony meatal wall destroyed. The proximal end of the facial was not to be found. The distal end located embedded in granulation. Horizontal semicircular canal necrosed, and its lumen open (fistula).

April 2. Muscular spasm.

April 4. Vomiting, muscular spasm, nystagmus appeared.

April 6. Symptoms of meningitis clearly defined.

April 11. Death.

NOTE: The patient's general condition did not warrant a second surgical procedure.

CASE III. N. P., 1½ years of age, came under observation at the Manhattan Eye and Ear Hospital April 16, 1907, having a purulent otorrhea for one year. Fever had been present for three days. Radical mastoid operation April 18, 1907. Among the findings was an eroded horizontal semicircular canal.

The child was normal from April 19th to 23d, when a Panse flap was cut. The next day, after flap operation (April 24, 1907), temperature rose to 100.6, P. 150, R. 52, and facial paralysis became evident.

April 26. Child gradually became normal, and continued so until discharged from hospital, showing nothing unusual in

its postoperative condition except the facial paralysis, which was complete (May 2, 1907).

May 11. Patient was brought in with T. 103, R. 28, P. 28, in a semiconscious condition. Immediate exploratory operation on labyrinth was performed. The stapes was found imbedded in granulations, and when manipulated evoked no nystagmus. The entire labyrinth was opened and pus was found in all the internal ear channels. Lumbar puncture at the time of operation gave cloudy fluid.

From May 12th to May 18th, gradually grew worse until death intervened.

NOTE: No finding at primary operation to direct suspicion to labyrinth.

CASE IV. F. S., aged 15 months, came under my observation at the Manhattan Eye and Ear Hospital suffering from acute purulent otitis media involving both ears. Immediate paracentesis.

June 10, 1907. The condition necessitated double simple mastoidectomy, which was performed on June 13, 1907. Case progressed uneventfully and was treated in the out patient department.

During the night of August 10-11 the child awoke with sudden attack of vomiting, accompanied with sudden facial paralysis on the right side, and was admitted to hospital the following morning with T. 103, R. 28, P. 130, facial paralysis and otorrhea on right side. Muscular twitching noticed in hands and arms. Pupils dilated, head drawn back, some convulsions immediately before operation.

Among the operative findings at the exploratory operation was stapes imbedded in granulations with perforated annular ligament. The labyrinth was opened completely (canals, vestibule, and cochlea). Facial nerve exposed.

Pressure on the jugular during operation caused increased flow of fluids from labyrinthine spaces.

August 13, 1907. Difference in size of pupils, the right larger than left, and patient died that day.

NOTE: Promptly opened labyrinth, which, however, proved unavailing. Increased flow of fluid when jugular was pressed upon, showing no protective barriers had been erected between local invasion and cranium.

CASE V. Male, 37 years of age, came under observation at



the New York Nose, Throat and Lung Hospital December 31, 1908, suffering from a fulminating type of acute mastoiditis necessitating immediate operation.

Simple mastoidectomy was performed upon a very pneumatic mastoid process, no unusual findings being noted at the operation.

January 1, 1909. Vomiting, pain in head and ear and slight horizontal and oblique nystagmus noted toward the healthy side. On the afternoon of the second day patient had a chill, temperature rose to about 103, R. 28, P. 112. The temperature ranged from 102-103, R. 26-28, and P. 112-120, until January 4, 1909. Meanwhile nystagmus had ceased, but sensation of dizziness continued. There was little or no vomiting, but meningeal signs became apparent, and on January 4, 1909, exploratory operation was undertaken. Among the findings we note that the horizontal semicircular canal was found eroded.

The pus from the mastoid process gave pneumococcus, as did also the lumbar puncture fluid.

Meningitis developed and patient died January 13, 1909.

NOTE: Operative proceedings were very limited upon the labyrinth, the eroded canal receiving attention only, because after the removal of the necrotic area nothing further abnormal was to be found.

CASE VI. Patient, male, about 30 years, appeared at the Manhattan Eye and Ear Hospital February 26, 1910, with a fully developed mastoiditis in an ear which had been operated upon for acute mastoiditis many years previously. Simple mastoidectomy was performed, evacuating, in addition to the mastoid contents, a subperiosteal, a perisinus, and an epidural abscess. Noteworthy was the finding that this combined abscess formation was completely shut off from the aditus ad antrum and the antrum by a plate of smooth, hard bone, extending from the tegmen to the mastoid tip. The tip was found perforated through the diagastric fossa, and the abscess in the neck muscles was evacuated.

March 2, slight facial paralysis became evident (4 days after operation).

March 10. The wound was converted into a radical mastoid operation. The posterior bony meatal wall was found to be necrotic, and this came away in one piece. A fistula was found

leading into the horizontal semicircular canal. It was not curetted. Panse flap and suture, and uneventful recovery.

NOTE: Only symptom was a partial facial paralysis.

CASE VII. Young adult, 27 years, presenting symptoms of acute mastoiditis, was operated upon at the New York Red Cross Hospital, June 1, 1910. Simple mastoidectomy. The mastoid process was found to be partly sclerotic and partly broken down. Dura of middle cranial fossa exposed by disease, and also an area in the lateral sinus wall, far down near where it crosses under the meatal wall to enter the bulb.

Recovery was uneventful, except for the continuation of the otorrhea, the middle ear never being dry. The postauricular wound gradually healed, presenting at the time the patient left for home a rather broad sinus leading to the antrum. When this was washed through with medicinal solution, if the temperature was not carefully looked after, the patient underwent spells of dizziness and normally elicited nystagmus.

On August 29, 1910, he returned to me, presenting a depressed scar behind the ear, in the anterior part of which a small fistula was found leading toward the antrum. From this pus flowed freely, and he also presented a profuse otorrhea.

The patient had intense headache, considerable nausea, but no rise in temperature. Caloric reaction absolutely negative. Deafness marked, although exact fork tests were not made. Immediate radical operation was undertaken. Among the findings, pus was demonstrable in the canals of the bony meatal wall. Panse flap and suture of wound.

August 31, 1910. T. 103 +, R. 20, P. 88. This gradually dropped to normal on September 3, 1910.

September 1, 1910. Spontaneous nystagmus toward the diseased ear noted. This was more marked when lying on diseased side. Dizziness was complained of, also more marked when lying on the diseased side.

These symptoms gradually subsided, until on September 4, 1910, they disappeared, since when patient has steadily improved.

September 18. The fork tests showed lateralization toward diseased ear, but only the C<sup>4</sup> fork heard per air conduction.

NOTE: This patient was treated by absolute rest in darkened room for three weeks.

In addition to these cases, I have had quite a number of

others which presented all, or a certain proportion of the clinical signs of labyrinthitis, but in whom when on the operating table I was unable to demonstrate the slightest lesion in the outer capsule of the labyrinth. All of these cases recovered after the performance of the radical mastoid operation only. I omit reporting such cases in detail, because sufficient substantiation of recoveries in cases with such symptoms after this operation is found in the literature.

#### LABORATORY FINDINGS NO INDEX TO CHARACTER OF THE DISEASE.

The pathologic investigation of this lesion presents only one aspect to the observer. This, in a way, accounts for the unsettled status of the entire subject of labyrinthine disease. Invasion of the internal ear channels show upon microscopic examination that the various labyrinthine channels are either wholly or partially filled with purulent inflammatory exudate. This is associated with varying degrees of destructive inflammation of the membranous labyrinth. According to the stage of the disease when under examination, the findings will vary from simple hemorrhagic infiltrate to a complete flooding of the integral parts with pus; or the advancing evidence of caries or necrosis of the osseous structure is presented, in addition to those findings.

The microscope delivers the same sort of evidence, whether the purulent exudate in the internal ear is produced by an acute middle ear or a chronic middle ear suppuration, unless the given case is a chronic labyrinthitis *per se*.

It is, therefore, easy to understand the divergence in results obtained by surgeons who, although apparently dealing with identical conditions when considered from the laboratory standpoint, are often handling totally different infections from the clinical standpoint. The laboratory, in this instance, can give no idea of the virulence of the infection, nor the serilogic condition of the patient invaded. With these factors in mind, it seems advisable to rearrange our classification of the infectious labyrinthine invasions into the following groups, for differing operative indications will be found applicable to each group:

## CLASSIFICATION OF LABYRINTHITIS.

1. Infectious labyrinthitis as sequela of acute middle ear disease.
2. Infectious labyrinthitis as sequela of acute exacerbation of chronic middle ear disease.
3. Traumatic labyrinthitis (hemorrhagic and infectious).
4. Infectious labyrinthitis following chronic middle ear disease (without acute exacerbation).
5. Chronic labyrinthitis.

For purposes of subsequent discussion, groups 1 and 2 and 4 and 5 are considered together.

To understand the present status of labyrinthine surgery, a brief discussion of the symptom complex and the indications for operation within these groups is in order.

## SYMPTOMS.

Infectious labyrinthitis following the acute middle ear disease, and to a slightly modified degree those following the acute exacerbations of chronic middle ear disease, runs a typically characteristic course. In my cases its onset was usually very sudden, after the expiration of a varying interval of time following the primary operation or lesion in the middle ear. The onset is found to be marked with a distinct rise of temperature and the sudden appearance of facial paralysis. This controverts the opinion of Dench,<sup>5</sup> who does not hold facial paralysis an early or common sign of purulent labyrinthitis. The course of the disease is rapid, and one has hardly time to note the symptomatology significant of the labyrinthine lesion before the predominating signs of meningeal involvement supervene and obscure the clinical picture.

Whether the labyrinth was opened or not, in my case at least, surgical intervention was unavailing in all those distinctly the sequelae of acute otitis. All died. In this connection it is interesting to read Scheibe's<sup>6</sup> report that as many cases die as recover, irrespective of operation.

At first I ascribed the deaths as due to the poorer resistance which was offered by the children (my first few cases happening among children), but the other fatal case in this group (Case V), occurring in a young adult of the working class, previously always in good health, contradicted this idea.



*A priori*, it seems that these cases present data which justify a simultaneous surgical intervention upon the labyrinth at the time of the primary operation upon the middle ear. Yet in the light of experience with cases among children and adults—especially the former—in whom facial paralysis, high temperature and even symptoms of meningeal irritation, all have been found to subside after either simple or radical mastoid surgery (a not uncommon observation)—are we prepared immediately to exenterate the labyrinthine channels upon the meager data thus far at hand?

Answered affirmatively, and we will find ourselves very often needlessly opening into the labyrinth with consequent total loss of a functioning ear. For the present, at least, my viewpoint is that these cases should be treated palliatively, opening into the labyrinth only when definite signs of its involvement are at hand, and the loss of the fewer number of cases—for a great many of this minority of all the cases with meningeal signs will die—is compensated for by the safety of the many who will recover with a functionally active hearing apparatus under conservative treatment.

I may add, in passing, another observation. The study of the operative findings in the cases which evidenced distinct lesions—erosions of the semicircular canal, open labyrinthine window, etc.—at the secondary operation, where no such lesion was apparent at the primary operation, and where the outer labyrinthine capsule was certainly not under pressure of pus during the interval (the first operation laying the wall free), these cases demonstrate that the openings leading into the labyrinth found at the second procedure are not evidence that the pus worked itself inward to the internal ear channels from the tympanic spaces, but that it was evacuated from the labyrinthine interior in the usual effort of nature to rid itself of pus. This observation substantiates a conclusion of Richards<sup>2</sup>, who finds that the outer labyrinthine wall will rupture sooner than the mesial one, given a purulent involvement of the labyrinth. The openings thus found at the second operation are to be regarded as points of eruption rather than gates of entry of purulent matter into the labyrinth.

In Case IV we note that during the performance of the operation on the labyrinth, after it was laid open, pressure exerted on the jugular produced an increased flow of laby-

rinthine fluids from the opened structures. This I interpret to mean that no obstructive barrier has been erected between the lymph and venous channels and those communicating with the internal ear spaces. In the rapid and virulent advance of the infection in the first 24 hours following after the first significant symptom, the way was still apparently open toward the cranium. In itself this characterizes the acute cases of labyrinthine infections. When we consider that the labyrinth is actually only a lymph channel which, through the development of the temporal bone, happens to be encased in bony walls, and incidentally only carries within itself the delicate end-organs of special nerves, then we must realize that its infectious invasion simulates the characteristic reactions of any other lymph channel in the body, and its inoculation by septic matter means rapid spread. The frequent implication of the jugular is a sign of this rapid spread of infection, as Richards has pointed out, when we consider the vascular connection between the veins of the vestibule, the semicirculars and the lateral sinus, and those of the cochlea and the inferior petrosal sinus. Therefore, surgical intervention must be most prompt and distinctly wide in scope if we hope to eradicate the infection.

The present status of our knowledge gives us no satisfactory indication to meet these requirements in time to avert the meningeal invasion which, once established, usually leads toward fatal outcome.

The existence of a difference between the purulent invasion of the labyrinth as sequela of acute and those following chronic middle ear cases is just beginning to receive some recognition abroad. Thus we find Jansen<sup>4</sup> stating that with acute otitis every vestibular disease is severe and dangerous, and every fistula in the semicircular canal is to be regarded as a sign of a present or imminent malady of the vestibular apparatus. Barany, Hinsberg and Scheibe<sup>5</sup> are of the impression that acute purulent labyrinthitis in acute ear cases more rapidly leads to meningitis than even the acute infections following chronic middle ear suppurations. Wanner<sup>7</sup> and Ruttin<sup>6</sup> also make distinctions between the two conditions, while Neumann<sup>8</sup>, on the other hand, from his pathologic studies, is disinclined to accept the existence of these differences.

## DIAGNOSIS OF ACUTE LABYRINTHITIS.

What means have we for diagnosing acute purulent labyrinthitis following acute infections of the middle ear spaces?

My cases, as well as a large proportion of those recorded in the literature, never give any sign characteristic of the class of case under discussion until meningitis is present.

Fever, headache, nausea and vomiting constitute no significant symptoms. The special signs from the labyrinth, such as tinnitus, are rare, and cannot be obtained at all from children. The estimation of impaired hearing also presents difficulties, because of the condition of the patient's faculties after the onset of labyrinthine infection, nor is it in any way characteristic of the lesion.

It is conceded that tuning fork tests are of doubtful value. (L. Page<sup>10</sup>.) In children, totally useless; in adults who are still in possession of their faculties the following is found: Bone conduction is usually impaired, and range of audition greatly reduced; the upper tone limit lowered, and the lower tone limit elevated. Richards<sup>2</sup> also found the fork tests of no value. In themselves, these findings are not significant.

On the other hand, if deafness develops under our eye, if we witness the sudden change in lateralization and the gradual lifting of the lower tone limit and the descent of the upper tone limit, in conjunction with loss of hearing for language, then and only then will the estimation of impaired hearing have any significance.

The estimation of disturbance of equilibrium is subjected to the same general criticism as applies to the hearing tests. It is not significant of labyrinthine trouble.

## SPONTANEOUS NYSTAGMUS.

Spontaneous nystagmus seems the only significant symptom, and it too often comes on too late to be utilized as a factor of surgical moment. In four of my cases it was present. In one it appeared seven days after onset, in another five days, in the third case it appeared on the second day, and in the other it presented itself four days after the first operation.

Shall the appearance of spontaneous nystagmus be our guide to operation? Barany says that if spontaneous nystagmus undergoes rapid decline it points to the labyrinth. If it per-



sists unchanged for several days it points to cerebellar disease. If it remains unchanged but strongly marked for 24 hours it originates probably in an endocranial abscess. My cases do not bear out this interpretation. MacKenzie<sup>9</sup> in discussion at the Otological Section of the British Medical Association warned against relying on the evidence of spontaneous nystagmus for diagnostic purposes. Like vertigo, he considers it a danger signal only, and we know that like vertigo it may be provoked by many other conditions besides labyrinthine involvement.

Nor can the direction of the spontaneous nystagmus be made of diagnostic import. In my cases its direction varied individually, and MacKenzie's<sup>12</sup> studies likewise demonstrated variability in the direction of the spontaneous nystagmus in the same class of cases.

By examination, we can test co-ordination (C. Stein), and we also have the vestibular tests of Barany. The former are almost impracticable of application, and the value of the latter is a debatable subject, in the type of case we are discussing.

#### CALORIC REACTION.

Since the introduction of the Barany caloric reaction something has been accomplished toward diagnosis of labyrinthitis. The test is simple in application, it supersedes the rotation tests and is fairly accurate in its significance. But in the acute infectious labyrinthine diseases it has many disadvantages which must give us thought.

Barany<sup>9</sup> recently stated that the vestibular tests are not sufficiently delicate to enable us to diagnose trifling diseases in the labyrinth; nor do they at any time, for that matter, enable us to determine what kind of pathologic changes are being enacted within the labyrinth. The test then fails when most needed to give timely warning that surgical intervention is indicated. Jansen<sup>4</sup> holds that the caloric reaction has often not disappeared at the precise time when the surgeon would have the most favorable situation in which to operate.

Furthermore the caloric reaction is of no value in cases where vertigo is pronounced and when it is only present when the patient is turned toward the diseased side (Jansen<sup>1</sup>). In Case VII of my series this was the finding. The caloric reaction was absolutely absent, yet the patient made a full re-



covery without operation. Jansen, in addition, reports that the inflammation may reach the brain before loss of vestibular function is manifest. Comparing his observations at the operating table and those from autopsy, in cases both with positive (i. e., elicited nystagmus) and with negative (loss of functional activity), he believes that only the negative finding has value, for he found with a "well conserved reaction"—to use his own words—cases of severe inflammatory alterations in both vestibule and semicircular canals, which often led to fatal meningitis.

Finally, as Lermoyez and Hautant<sup>11</sup> have shown, the caloric reaction only gives information regarding the functional activity of the posterior labyrinth exclusively.

#### DANGERS OF CALORIC TEST.

Finally not only is the caloric test of doubtful diagnostic value, but its performance, in the acute type of cases we are discussing, entails certain dangers. I have therefore not tried it on my cases except in Case VII, and here only before I really comprehended the patient's condition. My reasons for this attitude are based upon observations which Richards and others have made, and substantiation through my own findings, to which I have already referred when discussing fistulæ and erosion on the outer capsular wall of the labyrinth, as being evidence of efforts at evacuation of purulent products from within the labyrinth outward, rather than signs of inroads of pus toward the endocranium. To syringe even sterile water into the middle ear, as must be done (because the tympanic cavity is laid open by virtue of the radical operation), naturally creates back pressure on the pus contained in the labyrinthine channels, and to anyone who has taken the trouble to examine specimens of circumscribed labyrinthitis under the microscope, the delicacy of the protecting barriers which nature throws around the labyrinthine invasion must be evident. It requires but little additional force to break these up and thus disseminate the infection, and change what we hope may turn out to be a localized lesion into one which will be diffuse.

Scheibe<sup>6</sup> likewise finds reasons to omit using the caloric tests, believing them distributors of infection within the middle ear channels in this class of cases. Aside from the possibility of causing part of the water to penetrate the labyrinth

through a possibly open labyrinthine fenestra, he holds that the movements of the intralabyrinthine fluids which, according to Barany and others is necessarily provoked by the tests, that these movements are not to be considered in this connection indifferently. Finally Jansen<sup>4</sup> states his belief that "syringing" (caloric testing) should be avoided as long as we hope for a favorable or spontaneous cure of the case.

From all the above, it follows that absolute diagnosis or even probable diagnosis with the present means at our command is impossible before exploratory operation, and secondary exploratory operation is justifiable only when the entire clinical aspect of the case is studied, and when this warns us that meningeal invasion is threatening. Until the signs of meningeal irritation supervene, that is, signs of irritability from the arachnoid membrane, we have no indication for exploration of the labyrinth. This conservative attitude has the endorsement from clinical experience of Uffenorde,<sup>14</sup> Marx,<sup>15</sup> Gradenigo,<sup>16</sup> Scheibe,<sup>6</sup> Panse,<sup>6</sup> Schwartz<sup>6</sup> and others. Hinsberg,<sup>6</sup> in fact, adds that he believes the opening of the labyrinth in acute labyrinthine invasions in the course of acute otitic cases, a short time after rupture, to be a measure in itself not devoid of danger, and Barany, too, believes that in the absence of danger signs, a certain time may be allowed to elapse before operating, in analogy with the late operations in appendicitis.

Given a case with suspicious symptoms, after acute mastoiditis or following an acute exacerbation of a chronic purulent otitis, of what shall our treatment consist? I believe that Scheibe<sup>6</sup> has found the rational answer. The therapy consists in absolute rest, after the eradication of the primary foci in the middle ear spaces. He employed this method in four cases. The patients were kept almost immovable in bed for at least three weeks. He had one fatal termination, and in this case absolute bed rest was not enforced. He reports that in comparison with these uniformly good results, his results when he still treated labyrinthine suppuration as ambulatory cases were a uniformly fatal termination. Since all my previous cases with marked symptoms had died, whether operated on or not, I tried this method in Case VII, and can report my first recovery where labyrinthitis was distinctly diagnosed in the course of an acute middle ear infection. During

the rest period, the patient must be faithfully watched for meningeal symptoms, at the first sign of which operative intervention is urgently demanded.

Then prompt, radical surgical measures become the order of the day. Any hesitancy on the part of the surgeon, or in completeness in technic not only affords no advantage; it usually does harm. For, as Urbanschitsch<sup>13</sup> remarks, although the unfavorable course of meningitis cannot be arrested in the majority of the cases, nevertheless the timely operation on the labyrinth may prove successful, even in the presence of meningitis so far advanced as to give turbid or purulent fluid upon spinal puncture.

#### SURGERY OF ACUTE LABYRINTHITIS.

Regarding the surgery of this type of case, it is to be remembered that none of all the advocated surgical procedures completely meets the surgical requirements of the lesion. It is not possible to reach those cases where infection is present in the intricate cellular system at the pyramidal tip. Such cases cannot be controlled by operation, according to Winckler<sup>6</sup> and others. Laurant<sup>17</sup> also acknowledges the impossibility of obtaining complete elimination of pus foci. Time in performing the various technical procedures is an unfavorable factor, and it takes time and care to do the advocated procedures to totally expose the various semicircular canals combined with an extensive vestibulotomy and full exposure of the cochlea whorl.

The simplest procedure, and in my opinion the quickest performed, and the only one which meets all the surgical indications in these acute cases, is the total ablation of the petrosal pyramid with its contained labyrinth. This presents certain distinct advantages. The advantages reside therein that it eradicates the entire mass of infected cellular elements at the tip, including the entire labyrinth. It drains the posterior cranial fossa (the usual site of first infection of the endocranium) at its most naturally placed drainage point—at the location of the internal auditory meatus. The middle cranial dura is likewise rendered accessible. On the other hand, the dura is attached closely to the pyramidal tip, and conceivably might be torn in removing the bone. The petrosal sinuses are also liable to injury, but both these disadvantages very often



obtain during the performance of the Jansen-Neumann method of the labyrinthine operation. Finally, the proposed procedure entirely sacrifices the facial nerve.

I regard the class of cases in which the total extirpation of the petrosal pyramid would be indicated as most desperate, and it hardly seems to me to be a correct surgical attitude to permit a nerve (even as important a nerve as the facial nerve) to stand in the way of total removal of all accessible portions of the diseased ear.

Whether or not the profession is ready to take this stand in regard to sacrificing the facial, in the face of these desperate cases, I do not know. Gradenigo<sup>16</sup> only has even touched on this side of the subject, but I firmly believe that, in the face of almost universal fatal outcome of these acute cases of purulent labyrinthitis, the preservation of the facial nerve should not enter into consideration, and it is the conservation of the contiguity of this nerve which makes the various advocated labyrinthine operations difficult in technic and slow in their performance.

In conclusion, I may add that there are two absolutely indispensable conditions for success in labyrinthine surgery, no matter which procedure is selected, and these are that the labyrinthine interior must be made as accessible as possible to the surgeon, and he must thoroughly understand the surgical topography of these regions.

#### TRAUMATIC LABYRINTHITIS PURULENTA.

Under the heading of traumatic labyrinthitis, I group those lesions of the labyrinth which are the result of accidental injury, either extraneous or of surgical origin.\* The condition is rather rare from both sources. The protected position of the internal ear accounts for the rarity in the first instance, and a better understanding of the surgical technic of the radical mastoid operation mitigates the frequency of injury in the second instance. The horizontal semicircular canal is most frequently the location of the lesion (Jansen<sup>4</sup>). The next most usual site of the trouble is the accidental luxation

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\*The term "postoperative labyrinthitis" of Jansen, Alexander, Hinsberg and others is misleading. What they refer to is really a latent labyrinthitis observed in connection with chronic middle ear disease which becomes manifest after radical mastoid surgery.



of the stapes. The latter constitutes the more serious of the two injuries. I do not consider the accidental opening of the horizontal canal as possessing great factors of danger. The small size of its lumen and its readiness to occlusion in the face of inflammatory reaction soon places protecting barriers against the further propagation of infection. Furthermore, the absence of any communication between the semicircular canals and the cranium are likewise factors of safety.

When luxation of the stapes takes place the immediate access which it permits to the vestibule constitutes its danger. However, many cases are recorded which never progressed toward a general labyrinthine infection. When infection does, however, supervene, its onset is sudden. Within a day—according to Jansen, half a day—symptoms appear which are mostly unappreciated as to their significance, because the patient is still battling with the after-effects of his necrosis (Mygind<sup>18</sup>). The onset is manifest by vertigo, disturbance of equilibrium and nystagmus, and occasionally by a subjective sensation of tinnitus. By a careful observation of the case, the rise in temperature, headache, and the above mentioned symptoms make its diagnosis clear.

The differential diagnosis between traumatic infectious labyrinthitis and labyrinthine irritation cannot be definitely made, except by a consideration of the case as a whole. We interpret continued rise of pulse and temperature as significant of arachnoidal reaction, and its presence clears the diagnosis.

The infected cases naturally simulate the condition which I have described under the discussion of acute infectious labyrinthitis following acute middle ear disease, except in so far as we know the route of invasion in the traumatic cases.

In dealing with this condition, prophylactic measures are better than cure. It is a good practice, when performing the radical mastoid operation, to have the anesthetist not only watch the face for twitches from the facial during the removal of the posterior bony meatal wall, but also to watch the eyes for signs of elicited nystagmus during the removal of the two greater ossicles, and during the cleansing of the tympanic cavity. The slightest touch on the stapes will evidence itself by nystagmus, and will warn the surgeon in time. Likewise when performing the radical operation, if areas of the outer labyrinthine capsule look suspicious, or superficial erosions are

noted on the arches of the semicircular or upon the promontory, or when granulations are crowded about the oval window, do not remove them, they are as much protection barriers here as are the granulations situated upon the uncovered sinus in cases of perisinus abscess. Gradenigo even considers it dangerous to remove cicatricial tissue from the labyrinthine walls.

#### TREATMENT.

Given a suspected case of traumatic injury, at once remove all dressings, and inspect the labyrinthine capsule. Then wait and keep patient absolutely at rest. Operative intervention becomes indicated as soon as symptoms of labyrinthine infection are marked, persistent or on the increase. Jansen believes in early operation on these infected cases, because from his observations at autopsy compared with those at operation on similar cases, he finds that the operative procedures do not hasten death. Because only two of his cases showed spontaneous cure, he believes it better to open the infected part than to wait for labyrinthine symptoms to increase or diminish. When we operate early a favorable outcome is to be anticipated.

When operating on these cases, the opened labyrinth should not be curetted, so as not to detach any adhesions which may have formed with the meninges. (Boenninghaus.<sup>21</sup>)

#### LABYRINTHITIS CHRONICA.

The continued presence of a chronic middle ear suppuration, if permitted to run its course unchecked, eventually in a certain proportion of cases, invades the labyrinthine channels. The primary site of penetration toward the interior is a matter of controversy, but really is of little practical importance. Within the labyrinth, the invasion either spreads throughout the internal ear channels, or it becomes localized to a given part. It represents in the majority of cases the connecting link between chronic middle ear suppuration and fatal endocranial complications (Rendu<sup>19</sup>).

Its course is characterized by a period of latency, of varying intervals of time, which sooner or later becomes actively manifest as a purulent infection.

## DIAGNOSIS.

The diagnosis of serous labyrinthitis and circumscribed labyrinthitis are both open to question. From both conditions recovery may take place, and the tendency to describe all recovered cases (without operation) as circumscribed lesions is naturally inaccurate, for we have no positive methods of localization, and in the second place, the so-called cured cases of either type rarely come to intelligent autopsy examination. For the present, at least, we can designate this type of labyrinthitis under two groups only: (1) Chronic latent labyrinthitis; (2) chronic manifest labyrinthitis.

Regarding diagnosis, it is to be marked that pronounced or well defined signs of labyrinthine suppuration are rarely present, except in the cases of sudden invasion or rapid extension. This lesion rarely falls within this compass. Conceivably, when the process of erosion advances slowly, gradual accommodation of the vestibular function to the changed situation ensues, so that manifest symptoms are not always observable. (L. Page.) In a large percentage of cases the labyrinth is destroyed without characteristic symptoms.

The latent period in these cases is the most difficult, not only to diagnose, but it also presents difficulties for the formulation of operative indications. According to Rendu,<sup>19</sup> the disease is most frequently expressed by paralysis of the vestibulocochlear nerve, i. e., deafness for air and bone conduction, loss of vestibular reaction to rotatory and caloric tests. The most valuable data for diagnostic purposes are obtained from careful functional tests, the history of the case, and the study of the symptoms accompanying the chronic otitis.

Transient attacks of dizziness and vertigo are suspicious; the operative findings at the radical mastoid operation, presence of fistula—all give presumptive evidence toward labyrinthine disease. Schmiegelow<sup>20</sup> opens the labyrinth in these cases, when one or more fistulæ are present. He does not operate on the labyrinth when it presents an isolated fistula in the semicircular canal and the hearing is good.

When functional examination points toward labyrinthine disease, but the findings at the radical operation are negative—no fistula, and semicircular canals are not even darkened—it is advisable to wait an interval before operating, for while labyrinthitis may be present, it may already be on the road



toward encapsulation (Boenninghaus). When there are merely signs of labyrinthine irritation at the time of the operation on the middle ear, neither necrosis nor orifices being discernible, the opening of the labyrinth is not indicated. In this case, as well as in those where erosions are present, with or without labyrinthine symptoms, it is a good rule to keep patient under observation for some time.

Laurant<sup>17</sup> believes in curetting and disinfecting the local erosion or fistula, Gradenigo<sup>16</sup> strongly takes the opposite view, and Politzer goes even further in warning against the removal of granulations about a fistulous opening. MacCuen Smith<sup>22</sup> holds that a large majority of the fatal cases have occurred as the result of meddlesome surgery, which disturbed the protective barriers erected to prevent infection being carried to the meninges and the interior of the skull. West and Scott<sup>23</sup> operate in all cases wherein the vestibule and the ampullary extremities of the canal are involved. In fistula or necrosis of the external bend of the outer canal, and in the absence of all labyrinthine symptoms, they hold that the operator may limit himself to a simple curettage. When promontory or cochlea is found perforated, the diseased bone should be removed. In lesions of the semicircular canals Richards limits operative procedures to carious areas found.

The recommendation of expectant measures in circumscribed affections of the semicircular canals is based on the assumption expressed by Hinsberg, Jansen,<sup>4</sup> Bezold, Bourguet<sup>28</sup> and others, that this form of labyrinthitis frequently heals together with the middle ear and very rarely becomes the starting point for fatal complications.

The contraindications to the operative opening of the labyrinth are essentially based upon the fact—shown by pathologic anatomy and clinical experience—that in a certain proportion of labyrinthine suppurations, which are limited to segments of the labyrinth—protective adhesions form and prevent the propagation of the infection, thus permitting spontaneous healing. Interference is therefore unnecessary and even dangerous in these cases. The complete and rapid removal of the cause of the inflammation is all that is indicated (Gradenigo).

Let us now consider cases where there are marked symptoms suggesting labyrinthine involvement. My views coincide with those of Jansen, Hinsberg and others, that these



symptoms often all disappear with the performance of the radical mastoid operation. Of 190 cases which Jansen considered as being "decidedly labyrinthitis," there were only ten which proved fatal. In all of the 190 cases radical mastoidectomy only was performed. From this he believes that we have acquired evidence, at least regarding the vestibular portion of the labyrinth, that a great number of cases do not end fatally, nor in chronic ailment, but effect a spontaneous cure. In his opinion there is not the slightest doubt that in the majority of these cases disease of the entire vestibular portion of the labyrinth has been present, even though single or numerous instances of it may be regarded as a circumscribed disease of the semicircular canal.\* On the other hand, operation should be undertaken upon the labyrinth at the first definite sign of the progression of the lesion, and this must be determined by careful observation of the patient, studious estimation of the various functional tests, and the operative findings at the primary operation. When hearing is markedly impaired, caloric reaction is negative; if fever, vertigo and headache are present it is safer to operate than not to operate.

Summarizing the indications for operations on the labyrinth we contend:—

1. That the indications for opening the labyrinth in acute infectious labyrinthitis following acute middle ear suppurations, and following acute exacerbations of chronic middle ear suppurations, are still a debatable question. If operation is elected, then it must be extremely extensive in area, and promptly follow the first sign of meningeal irritation. That

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\*The suppurative affections of the labyrinth which heal spontaneously include: (1) Cases of labyrinth suppuration occurring in the course of a purulent cerebrospinal meningitis, the middle ear remaining intact; (2) otitic purulent labyrinthitis, in which an abscess forms in the labyrinth as the result of suppuration of the membranous labyrinth, whereas the bony labyrinth and the petrous bone are not involved in the inflammation; (3) cases of purulent labyrinthitis in which the bony lateral wall of the labyrinth is first affected by way of the middle ear, and the pus at last ruptures into the labyrinth through a fistula, the remainder of the labyrinth remaining normal. Needless to say that recovery takes place at the expense of the nerve end organ terminals. (Deafness and total loss of irritability of vestibular and semicircular apparatus in the majority of cases. In the minority of cases, a remnant of hearing and a positive reaction to irritability of the semicircular and vestibular apparatus are left behind.) (Alexander) (25).

in this class of case no reliance should be placed upon data from functional examination.

2. When labyrinthine suppuration appears as the sequela of chronic middle ear suppurations, or cholesteatoma, without demonstrable disease of the labyrinth, then operation may be limited to the middle ear spaces, a retrogression of the labyrinthine symptoms being within the range of possibility. Fistulæ of the semicirculars, and erosions of the promontory, in cases with intact hearing, do not require operative intervention. When symptoms of labyrinthine involvement appear in the course of suppurative middle ear disease, or after operations on the middle ear, without fever, and without signs of meningeal irritation, then an exact functional examination to determine the activity of the labyrinth is first demanded. If found functionally active, but of less intensity in reaction, no immediate labyrinthine operation is necessary, although surgery may become a necessity at a subsequent period. If function is totally lost, then prompt operation on the labyrinth, opening it extensively, is indicated to guard against meningitis.

#### REMARKS ON TECHNIC.

The many operations which have been published and advocated by various authorities are evidence in themselves that no one given method of procedure meets the surgical requirements of purulent labyrinthitis.

The situation should be met by individualization necessitated by the conditions found in the given case.

I do not intend detailing the various operative procedures advocated from so many different sides. They really differ more in regard to technical details than regarding fundamentals. Personally I prefer the Richards operation,<sup>2</sup> and when I have the choice, that procedure is employed in my cases.

In the interest of completeness, I will add the following remarks on technical points:

The Richards operation starts by entering the labyrinth behind the facial ridge. The semicirculars are thus opened from behind, the facial nerve is conserved, then the vestibule and finally the cochlea is opened. The posterior cranial fossa is not opened as a step in the labyrinthine surgery.

The Jansen-Neumann method opens the posterior cranial fossa as part of the procedures on the labyrinth. It guaran-

tees the complete suppression of deep-seated diseased bone segments, from which endocranial complications may start. Furthermore, it permits an easy exploration of the posterior and middle cranial fossa. This operation is very radical, dura is exposed to a great extent, and this very exposure interferes with the progress of the operation by producing sagging into the wound during the operation and during the after-treatment. Rendu<sup>19</sup> finds it impossible to curette the anterior and inner portions of the labyrinth on this account. Gradenigo holds the Jansen-Neumann method too aggressive. Jansen, however, considers his operation especially adapted to cases where endocranial complications exist, and Neumann thinks it preferable to expose the cranial fossa at once for both diagnostic and operative purposes.

The method of Hinsberg,<sup>27</sup> Bourguet<sup>28</sup> and Botey<sup>29</sup> are similar. They, however, reach the vestibule from in front of the facial ridge, then enter the promontory, etc. This method of procedure leaves a blind pocket—a cul-de-sac—at the lower orifice of the semicircular canal, besides greatly endangering the facial nerve. Jansen<sup>7</sup> and Frey<sup>7</sup> regard the procedure as dangerous.

Uffenorde's operation<sup>14</sup> and its modification by Bourguet endangers the facial nerve, besides being one of the most complicated technical procedures.

Hautant<sup>30</sup> proceeds in a manner similar to Hinsberg, and after the vestibule is opened the end of the external semicircular canal is exposed. He follows the deeply lying branch of this canal until it reaches the vestibule, thus opening from in front and from below. He then individualizes the subsequent procedures according to the findings at operation. Dura of the posterior cranial fossa is not exposed in the face of the endocranial complications.

The method of Hammerschlag and Frey<sup>31</sup> is particularly fitted for cases where the lateral sinus is situated far back, according to Neumann.

These constitute the most commonly known of the various operations on the labyrinth. With the requisite knowledge of the topographic anatomy and a working technic in any one of these procedures, the varying details of these operations are easily at hand for anyone, and their respective values can be individually established.

616 Madison Avenue.



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## LX.

### CONCERNING THE CAPSULATED BACTERIA IN THE PRODUCTION OF ACUTE MIDDLE EAR AFFECTIONS.

BY H. B. GRAHAM, M. D.,

SAN FRANCISCO.

(From the University Ear Clinic, Prof. Urbantschitsch,  
Vienna.)

The part that the capsulated bacteria (pneumococcus, Friedländer bacillus, streptococcus mucosus) play in the production of acute middle ear suppuration and their complications has been pretty thoroughly worked out in the last few years and is of enough importance to warrant a review. Of the three, the Friedländer bacillus seems to be least frequently observed, the streptococcus mucosus the most often. As regards age, the pneumococcus is more frequently found in children, the streptococcus in adults.

Netter,<sup>1</sup> in 1887, found the pneumococcus in the labyrinthine fluid in a case that had died of meningitis, and in the same year Zaufal<sup>2</sup> isolated the Friedländer bacillus and again the diplococcus pneumoniae, Fränkel-Weichselbaum, in two cases of acute middle ear suppuration. In June of the same year Dr. Emil Pins, of Vienna, pointed out the possibility of the Friedländer bacillus passing up the eustachian tube and producing a middle ear suppuration in children. Zaufal, Netter and Weichselbaum, in 1889, agreed that the pneumococcus was capable at least of producing the otitic complications. From this time on many observations appeared on the influence of the pneumococcus in acute middle ear affections, which were summed up by Leutert,<sup>3</sup> in 1899, when he said that the pneumococcus is the more mild cause of acute affections, on account of the facts that the pus ceased earlier, there is a lower temperature, the findings at operation are smaller, and

there is a shorter after-treatment necessary than in those due to other bacteria; however, the pneumococcus has more of a tendency to pass from antrum to periphery, leaving but little destruction of the septa, and the active pyemic process lies more in the periphery of the mastoid at the time of operation, whereas the streptococcus has more of a tendency to break everything down as it advances. The pneumococcus cases have more of a tendency also to remain latent for some time after the acute infection, and later show a tendency to acute recurrent attacks in the mastoid.

Concerning the question of priority in the discovery of the streptococcus mucosus capsulatus there is much uncertainty; suffice it to say that before Schottmueller's work appeared in 1903 there had been organisms isolated from various sources that clearly resembled his, namely, by Knuth,<sup>4</sup> 1895; Seitz,<sup>5</sup> 1896; Binaghi,<sup>5</sup> 1897; Weinberg,<sup>7</sup> 1899; Bonome,<sup>8</sup> 1890; Lewcowitz,<sup>9</sup> Richardson,<sup>10</sup> and Howard and Perkins,<sup>11</sup> 1901, and Longcope,<sup>12</sup> 1902. Of these, those of Bonome and of Howard and Perkins seem to be most certainly the same organism. As the cause of otitic meningitis, Schottmueller found it in 1899, and subsequently in two other cases, 1900, 1902.

In the United States, Howard and Perkins, 1901; Longcope, 1902, and Burger,<sup>13</sup> 1905, all got the streptococcus mucosus, which they describe, from cases of otitic complications.

Schottmueller,<sup>14</sup> in summing up his findings in the three cases of meningitis, in 1903, says that it is interesting to note that in each of the cases (1) the meningitis was following an acute otitis; (2) the bone was relatively rapidly necrosed; (3) the drum membrane showed a remarkably small amount of pathology. The meningitis in all three cases progressed very rapidly, with severe symptoms and high fever, to death within a week. Heims<sup>15</sup> isolated the streptococcus mucosus from the ear in pure culture, and in 1904 described a case of middle ear suppuration in which the roof of the antrum and the zygomatic process were necrotic, and from the pus of which Rosenthal isolated the same organism.

In 1907,<sup>16</sup> at the Congress of the German Otological Society, Kummel read a referat on the bacteriology of acute middle ear disease, in which he analyzed the work of Supfle, and was followed by papers by Denker,<sup>17</sup> Kobrak,<sup>18</sup> Neumann and Ruttin,<sup>19</sup> and Wittmack,<sup>20</sup> in which Supfle, taking

the bacteria from the middle ear, found a percentage occurrence of the mucosus, 13.95; of the pneumococcus, 18.61; and Denker, taking them from the mastoid at operation found a percentage of mucosus, 13.87, and pneumococcus, 0.

Kummel observed, as Schottmueller had, that the streptococcus mucosus produces the late manifestations even after the healing of the acute otitis, and Kobrak, in his excellent paper, summed up the differences clinically by saying that where the streptococcus longus produces the protracted (pyemic, septic) form, the pneumococcus produces the cyclic, and the streptococcus mucosus the interval forms, the latter showing no continual course between the acute attack and the complication period, but a more or less free interval and a tendency for the primary focus to heal after the primary attack, or a few repeated acute exacerbations, while the process continues often latent in the immediate surroundings. Wittmack gave the percentage of mucosus cases which leads to complications as 75, and added that in children it is much less frequently seen than the erysipelatous forms, these being secondary to scarlet fever, measles, angina, arthritic rheumatism, etc., whereas, the mucosus forms are more often primary, possibly (with a great question) following pneumonia in rhinitis.

Neumann and Ruttin found out of 24 cases of streptococcus mucosus that 22 came to operation, and only two healed spontaneously. They hold with Politzer that the presence of an acute mastoiditis is more dependent upon the anatomic structure of the mastoid rather than upon the form of bacterial infection; that is, that the pneumatic form of mastoid has a predisposition to encourage the growth of bacteria. On the other hand, the course of the disease is dependent more on the form of bacteria, the capsulated bacteria producing one type and the noncapsulated another.

To differentiate clinically, they say, the bacteria within each individual group is difficult, still the streptococcus mucosus cases present a certain group of symptoms which are fairly constant, namely (1) an isolation of the inflammatory process in the middle ear in the first or second week; (2) the remaining of a marked disturbance of hearing and constant subjective noises; (3) a drum membrane that reminds one of a secretory catarrh, showing a moist, pale, dull, reddish color, the details



recognizable, but the sharpness of outline obscure and the light reflex not well marked. There is no earache and but little tenderness to pressure over the mastoid, and then only in small areas. A paracentesis gives a mucous or mucopurulent exudate. The disease keeps this picture until the advancing destruction of bone has produced a complication that is dangerous to the life of the patient, or has made itself manifest externally. The symptoms are, as a rule, so mild that the patients often come first to the physician with a well-marked perisinous or extradural abscess, or even a meningitis, and then the history is brought out that the dull, indefinite aching in the ear region and partial deafness have been present for weeks or months.

The latest work on the subject has been recently published by Dr. L. Artz,<sup>21</sup> who states that of seven otogenic pyemic meningitis cases which came to autopsy at the Policlinic Hospital in the last year, 3, or 43 per cent, were due to the streptococcus mucosus.

The following three cases, which have been observed at the Urbantschitsch Clinic in the last few months, will illustrate the course of the disease due to the capsulated bacteria:

Case I. W. S., twenty-five years. For eight weeks a slight left-sided earache and discharge following an acute rhinitis. No dizziness, no fever. For the last four days the discharge had ceased. The upper anterior portion of the external canal was slightly reddened and sunken, the drum membrane was swollen slightly in the upper half, the lower half was clear, no secretion, no perforation. Mastoid tender to pressure over the tip. Operation: The mastoid cells were red, filled with granulations, but no pus. The general appearance was that of a healing mastoiditis. The operation was considered finished when a small area of granulations was noticed near the middle of the sinus region. This marked an erosion in the bone which allowed a small curette to pass into a large area of granulation tissue, covering the lower half of the sinus and the bulb. On removing the bone from over the sinus a large peribulbar abscess was entered. Bacteriologic findings: Pneumococcus. In this case the process in the middle ear and mastoid had become so quiescent that the advisability of an operation at all was in doubt, and were it not that the cause was evidently a capsulated bacterium, the case



would not have been operated until there had developed a sinus thrombosis or other more serious complication.

Case II. A. S., twenty-nine years. Twelve weeks previously sudden pain in the left ear. This became less in a couple of days, but never entirely disappeared. A slight supuration continued until four days before admission to the hospital. There was some dizziness, no nausea, no fever. On entrance a mild occipital headache was present. Left external auditory canal somewhat swollen; drum membrane pale red and bulging; central perforation; pulsating pus at the bottom of the canal; superior posterior portion of the bony external canal sunken. No tenderness over the mastoid. Operation: The mastoid presented a hard, thick cortex, with a medullary portion that showed a softening which reached well under the auditory canal and back to the sinus, from the knee to the bulb. The sinus was covered with the hard cortex still, so that the process had produced an undermining and a perisinous abscess. There was but little pus present and the amount of granulation tissue increased from antrum to sinus, so that the most active part of the process was close up to the sinus. Bacteriologic report: *Streptococcus mucosus*.

Case III. J. L., aged thirty. Admitted April 12, 1910. Six weeks previously patient had had a sudden double-sided ear-ache, which lasted in a mild form for four weeks. The discharge began four days after the initial attack and continued also for four weeks. Fourteen days before entrance there was a tenderness behind the left ear. There was a slight headache, no dizziness, no nausea. Temperature on entrance, 38.4° C. Drum membrane pale red, bulging, details not recognizable, no perforation, no discharge, sinking of the posterior superior external bony canal, mastoid process tender to pressure. Operation: Opening of the antrum. At the first stroke of the chisel a large quantity of pus appeared under heavy pressure. The sinus was laid free from knee to bulb. The abscess was continuous with a Bezold's abscess, which reached to the base of the skull, and which had broken through from the tip of the mastoid. During the operation, which was performed by one of the aspirants of the clinic, there was an injury to the sinus. From the twelfth of April to the eighteenth of May the patient had a normal after-treatment. On the eighteenth I saw the patient at 11 a. m.; the wound was nearly

closed to the surface of the skin with healthy granulations. The drum membrane nearly normal; no tenderness over the ear region. There was a dull left-sided headache, which the patient had noticed for two days; pulse normal; wound was dressed and patient discharged. He was brought in at 6 p. m. on the same day by the emergency service, unconscious, with restlessness and stiffness of the neck; reflexes present; corneal hyperesthesia; no nystagmus; pulse 92. He had been aphasic in the afternoon. Lumbar puncture gave a cloudy greenish-yellow spinal fluid, which came out under high pressure, and on standing left a fibrin coagulum. Diagnosis: Meningitis. Operation: Nothing abnormal was found in the wound or in the meninges at the site of the operation, and no brain abscess. Bacteriologic report from the spinal fluid: Pure culture of streptococcus mucosus. Autopsy: Diffuse streptoleptomeningitis; small dural hemorrhage; small thrombus at the beginning of the sinus longitudinalis. Lobar pneumonia in the left lower lobe. Atrophic cirrhosis of the liver; chronic splenic tumor; chronic perisplenitis; parenchymatous degeneration of heart and kidneys.

The sudden appearance of the meningitis over a month after the original operation, and three months after the primary acute attack, at a time when everything was quiescent, the short duration of the meningitis and the severe symptoms are all characteristic of the streptococcus mucosus.

The prognostic value of the diagnosis of the capsulated bacteria in acute middle ear affections is of the utmost value, as no case due to these bacteria should be allowed to pass from the physician's care until all possibility of a complication is gone, and at the least indication operative interference is justifiable. If in the course of treatment the capsulated bacteria are found, the physician should be prepared for a long siege of waiting and careful observation, and the relatives should be warned of the danger of complications, in order to insure an early operation should symptoms indicate.

For permission to publish these cases I am indebted to Professor Dr. Urbantschitsch and Assistant Dr. Ruttin, of the K. K. Universitäts Ohrenklinik, Vienna, to whom I wish here to express my thanks.

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## LXI.

# THE ANATOMIC EXPLANATION OF VESTIBULAR NYSTAGMUS.

BY LOUIS K. GUGGENHEIM, M. D.,

ST. LOUIS.

As a result of the admirable work done by Barany and others in Vienna during the last five years, numerous articles dealing with the clinical significance of nystagmus have been published. Other than the mere statement that the two vestibular apparatuses normally exert, through the vestibular nerves, a certain influence over the nuclei of the eye muscle nerves, and that a disturbance in the equilibrium of this influence results in nystagmus, little has been written concerning the actual anatomic explanation of the phenomenon. For this reason, and in view of the importance to otologists of a thorough knowledge of the subject, the following paper has been prepared.

### ANATOMIC MATERIAL.

The illustrations, with the exception of numbers one and seven, are photographs of specimens carefully selected from several hundred serial sections made by the author while at the neurobiologic institute of the University of Berlin. The first picture is of a temporal bone from the writer's collection. The seventh illustration is a photograph of a specimen belonging to the University of Vienna.

The sections of the medulla are stained according to the Weigert-Pal method. The ear specimens are stained partly with hematoxylineosin, partly with Van Gieson's picric acid fuchsin.

### DESCRIPTION OF SPECIMENS.

Of the following illustrations I-VII show the relations of the vestibular apparatus and the endings of the nervus vestibularis in the labyrinth. A, B, C and D show the vestibular



nuclei, the nuclei of the abducens and oculomotor nerves, and the central course of the nervus vestibularis.

Fig. I. Sagittal section of a normal adult temporal bone, showing the prominence of the horizontal semicircular canal on the median wall of the mastoid antrum (1). Just inferior to this is the facial canal (2). Anterior to the facial canal is the median wall of the tympanic cavity with its promontory (3), fenestra ovalis (4), entrance to the fenestra rotunda (5), etc. Anterior to the tympanum is the carotid canal (6). Inferiorly is the bony vault for the jugular bulb (7). The object of this picture is to give a clear idea of the relations of the outer wall of the vestibular apparatus to the tympanic cavity and mastoid antrum.

Fig. II. Frontal section through the tympanic cavity and labyrinth of a three months' embryo. Superiorly is seen the prominence of the horizontal semicircular canal (1). Below this is the facial nerve (2). Inferior to the facial is first the oval window with stapes (3), next the promontory (4), then the round window closed by the membrana tympani secundaria (5). Superiorly in the labyrinth is the ampulla of the horizontal canal (6). On its external wall is a crista acustica, below which may be seen the communication between the ampulla and utriculus. On the lateral wall of the utriculus (7) is its macula acustica. To the median side of the oval window is the cysterna perilymphatica of the vestibule (8).

Fig. III. Frontal section through the external auditory canal, tympanic cavity, mastoid antrum, labyrinth and internal auditory meatus of a normal adult temporal bone. On the median wall of the antrum is the prominence of the horizontal semicircular canal (1). Above and internal to this is the anterior vertical semicircular canal (2). Inferior to the horizontal canal is the facial nerve (3), the fenestra ovalis (4), the promontory (5), and the cellulae tympanicae (6). To the median side of the promontory is the beginning of the cochlea (7). Internal to the foot-plate of the stapes is the cysterna perilymphatica of the vestibule (8). Above this is the utriculus (9), which communicates superiorly with the ampullae of the horizontal and anterior vertical canals. To the median side of the vestibule is seen the internal auditory meatus (10). This picture is given chiefly to demonstrate the position of, and intimate relation existing between the ampullae of the horizontal and anterior vertical semicircular canals.

Fig. IV. Horizontal section through the middle ear and labyrinth of a child's temporal bone. The region shown is that of the round window. Just anterior to the membrana tympani secundaria (1) is the beginning of the cochlea (2). To the median side of the fenestra rotunda is the ampulla of the posterior vertical semicircular canal (3). On the anterolateral wall of the membranous ampulla is the crista acustica or crista ampullaris (4). This picture demonstrates the close relation existing between the ampulla of the posterior canal and the round window.

Fig. V. Transverse section through the ampullary end of a semicircular canal showing crista ampullaris (1). It is seen that the membranous ampulla almost fills the cavity of the osseous (2), whereas the membranous canal elsewhere only occupies about one-fifth of the osseous. The membranous ampulla is attached to the osseous by means of numerous bands of connective tissue (3), which serve for the passage of blood vessels as well as for the support of the ampulla. The crista acustica is seen to be composed of, first, a loose connective tissue basis, through which pass the fibers of the nervus utriculo-ampullaris. Resting upon this is a more compact layer of connective tissue, the membrana propria (4). Above the membrana propria is a layer of endothelial cells (5), the center ones of which carry the long hairs which form the cupola (6). These hairs are held together at their ends by means of a homogeneous semisolid substance (7). To the lateral side of the ampulla are seen fibers of the nervus utriculo-ampullaris on cross section (8). The membranous canal (9) is filled with endolymph, the surrounding space containing perilymph.

Fig. VI. Horizontal section through the oval window and vestibule of an adult temporal bone. Laterally is the foot-plate of the stapes (1). Posterior to this is the facial nerve (2). The large space in the vestibule to the median side of the stapes is the cysterna perilymphatica (3). Attached to the posterior and median walls of the vestibule is the utriculus (4). On the lateral wall of the utriculus is its macula acustica (5). Posteriorly are seen cross sections of the vestibular nerve fibers (6).

Fig. VII. Membranous labyrinth of the right side prepared from a normal temporal bone. Anteriorly is the cochlea (1). At

the beginning of its basal turn is the fenestra rotunda (2). Just above and anterior to the round window is the sacculus (3). Communicating with the sacculus superiorly and to its posterior side is the utriculus (4). Posteriorly are seen the three semicircular canals; above the anterior vertical (5), in the center the horizontal (6), below the posterior vertical (7). The ampullæ (8) of the anterior vertical and horizontal canals are seen together superiorly. Inferiorly, in the region of the round window, is the ampulla (9) of the posterior vertical canal. The purpose of this illustration is to show the exact position of all three semicircular canals, their relations to each other and to the remainder of the labyrinth.

Fig. A. Transverse section of the medulla through the upper end of the inferior olive (1), showing the beginning of the ramus cochlearis (2) of the nervus acusticus. The anterior cochlearis nucleus (nucleus accessorius acustici) (3) is seen anterior to the corpus restiforme (4) and is buried in the trunk of the nervus cochlearis. This nucleus takes up most of the fibers of the nervus cochlearis. Some of these fibers, however, combined with fibers springing from the anterior cochlearis nucleus curve laterally around the corpus restiforme as the lateral acoustic root and find an interruption posterior to the corpus restiforme in the nucleus cochlearis dorsalis, the so-called tuberculum acusticum (5). The continuation of this system of the cochlearis is carried out by the striæ acusticæ (6), which run along the floor of the fourth ventricle toward the median line, crossing at different levels. Near the median line the fibers separate a little to take in the nucleus eminentiæ teretis (7). Just anterior to these striæ is the small cell triangular vestibular nucleus, the nucleus vestibularis parvicellularis (8). To the lateral side of this nucleus is seen in transverse section the spinal acusticus root, which may be divided into three parts; most median are the descending fibers of the vestibular (9), laterally the connection between the nuclei of the medulla and the cerebellum, the tractus nucleocerebellares (10), which touches the restiform body, and between the two the large cells of Deiter's nucleus, the nucleus vestibularis magnocellularis (11).

Fig. B. Transverse section through the medulla at a higher level than section A. The ramus vestibularis is here seen in its entirety (1). The chief mass of fibers is directed toward the



small cell triangular vestibular nucleus (2), while a second part curves toward the large cells of Deiter's nucleus (3). Some of the fibers of the vestibular together with fibers from Deiter's nucleus take the dorsal course of the restiform fibers (4); the first reach the small cell nucleus angularis (Bechter nucleus) (5), the second passing to the nucleus fastigii in the cerebellum. The nucleus angularis is situated median to the brachium conjunctivum. A bit of the facial nucleus is seen, the fibers of which surround the nucleus of the abducens (6), after which they form the ascending arm of the facial. This is situated just dorsal to the fasciculus longitudinalis posterior (7).

Fig. C. Transverse section through the beginning of the pons, showing the continuation of the acoustic fibers. In the tegmental region is seen a bundle of fibers, which originate in the ventral cochlearis nucleus, anteriorly winding around the spinal trigeminus root and then curving in a bow toward the median line, where they cross. This bundle, which in animals with a shorter pons lies exposed on the surface, is the corpus trapezoides (1). In its lateral third is buried the superior olive (2). From the corpus trapezoides radial bundles extend into the olive anteriorly, while dorsally the so-called pedicle fibers (3) enter. These dorsal fibers are the continuations of the striæ acousticæ. In the corpus trapezoides small cell nests form the trapezoid nucleus. The superior olive lies in close relation to the facial (4) and abducens (5). The nucleus of the facial lies dorsolaterally, the trunk passing to the lateral side of the olive. The abducens passes through the tegmentum median to the olive. In this section are also seen remains of the large (6) and small (7) cell vestibular nuclei. The small cells just posterior to the cells of Deiter belong to the nucleus angularis. At (8) is seen the nucleus of the abducens.

Fig. D. Transverse section through the anterior portion of the cerebral peduncle, through the red nucleus of the tegmentum (1), and through the superior corpus quadrigemina (2). The picture is given chiefly to show the position of the oculomotor nucleus (3). This nucleus consists of several distinct groups of cells lying on the floor of the aqueduct (4) close to the middle line and nearly corresponding in position to the superior quadrigeminal body. It is just dorsal to the posterior



longitudinal fasciculus (5). Anteriorly are seen fibers of the oculomotor nerve (6).

DESCRIPTION OF CENTRAL COURSE OF THE VESTIBULAR NERVE  
AND OF THE DIFFERENT NUCLEI WHICH AID IN THE  
CAUSATION OF NYSTAGMUS.

The vestibular nerve fibers, after being interrupted in the vestibular ganglion in the internal auditory meatus, pass directly to the medulla oblongata, in which to the median side of the corpus restiforme (B4) they divide into an ascending and a descending branch, the latter forming the most median portion (A9) of the spinal acoustic root which descends as far as the region of the hypoglossus. Some of these fibers end in the small cell vestibular nucleus (B2), their continuations, which may be followed down to the hypoglossus, being known as the descending vestibular nucleus, nucleus intercalatus Staderini. Direct continuations of the ramus vestibularis also reach Deiter's nucleus and the nucleus angularis. From Deiter's nucleus (C6) proceed fibers on the one hand to the nuclei of the eye muscle nerves (C8-D3), through the fasciculus longitudinalis posterior (B7-D5) (some of the fibers crossing, others remaining on the same side), and to the cerebellum; on the other hand, crossed and direct fibers pass downward to the motor cells of the anterior horns of the cord. If any of the fibers go direct to the cerebral cortex, or if all are first subjected to an interruption in the nuclei of the eye muscle nerves, is still an open question.

Concerning the exact course of the central tracts from the vestibular region to the cerebrum, it is known only that they pierce the substantia reticularis of the region just above the transverse fibers of the pons, pass to the thalamus, and from there, after an interruption, reach the cortex and are supposed to end in the posterior part of the parietal lobe.

PRACTICAL APPLICATION.

From the illustrations and description it is seen that the two vestibular apparatuses are brought into relation with Deiter's nucleus by means of certain of the vestibular nerve fibers. Further, that Deiter's nucleus is brought into relation

with the nuclei of the eye muscle nerves through the fasciculus longitudinalis posterior. As a result of these relations, the two vestibular apparatuses are enabled to exert a definite influence over the eye muscle nerves. Normally this influence is equal. Any disturbance in the equilibrium of these vestibular stimuli results in an oscillatory movement of the eyes, nystagmus. By means of the fibers passing from Deiter's nucleus to the cerebellum, disturbances of the latter may also give rise to nystagmus.\* In the vestibular form of nystagmus the slow component alone is due to vestibular influence, the rapid component being the result of voluntary effort to bring the eyes back to the normal position.

In the diagram presented, the entire central mechanism of vestibular nystagmus may be studied. V. A. represents the vestibular apparatus of the left side. The vestibular nerve fibers are first interrupted at V. G., the vestibular ganglion in the internal auditory meatus. From here they pass directly to the medulla, some ending in the small cell vestibular nucleus V. N., others in Deiter's nucleus D, and still others in the nucleus angularis A. From Deiter's nucleus and the nucleus angularis pass fibers directly into the cerebellum C. From Deiter's nucleus fibers pass also to the fasciculus longitudinalis posterior F. L. P. The fibers of the fasciculus longitudinalis posterior are seen to communicate with, first, the abducens nucleus Ab. and superiorly with the oculomotor nucleus Oc., both of the right side. From these two nuclei of the right side the two nerve trunks are traced to the eyes. Although Deiter's nucleus of each side is in communication with the abducens and oculomotor nuclei of both sides, the crossed fibers are the more important. For this reason the latter alone are given in the diagram.

At G. A. is the cortical center for voluntary movement of the eyes to the left. This center, in gyrus angularis, gives rise to the rapid component of vestibular nystagmus.

The diagram illustrates how vestibular nystagmus may be caused to the left from, for instance, an increase in the normal stimulation from the left vestibular apparatus. The increase in the normal stimulation passes from V. A.-V. G. directly to

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\*The fibers passing from Deiter's nucleus to the cord explain the disturbance of equilibrium which accompanies marked nystagmus.

D. of the left side. From D. most of the stimulation passes through F. L. P. of the right side to the abducens and oculomotor nuclei, Ab. and Oc. From these two nuclei the stimulus finally reaches the eye muscles through the abducens and oculomotor nerves. The result is a slow movement of the eyes to the right. As soon as the eyes have reached extreme vision to the right from vestibular action, they are jerked back toward the left by voluntary action originating in the gyrus angularis of the right cortex. The center for voluntary vision in the right gyrus angularis acts first upon the cells of Monakow (M in the diagram) of the left side (center for vision to the left). From here the stimulation passes through a supranuclear tract to the two nuclei Ab. and Oc. of the left, and thus finally to the eyes. The action then of the gyrus angularis is to cause the rapid component of vestibular nystagmus.

#### EXPLANATION OF THE PERIPHERAL MECHANISM OF VESTIBULAR NYSTAGMUS.

Having explained the central mechanism of vestibular nystagmus, the peripheral remains to be considered. Each vestibular apparatus consists of three semicircular canals (VII-5, 6, 7) and a vestibule, the latter containing the utricle (VII-4) and the saccule (VII-3). Each semicircular canal possesses an indifferent and an ampullary end. In the ampullary ends of the membranous canals are situated the cristae acusticae (V-1). Resting upon each crista is a cupola (V-6) consisting of minute hairs held together by a homogeneous semisolid substance (V-7). The cristae acusticae represent the nerve endings of the nervus vestibularis in the semicircular canals. The macula acustica of the utricle (VI-5) represents the nerve endings of the nervus vestibularis in that organ. Laterally, just to the median side of the inner wall of the mastoid antrum are the ampullae of the horizontal and anterior vertical canals (VII-8). Internal to the region of the round window is the ampulla of the posterior vertical canal (IV-3 and VII-9). Midway between the two ends of the posterior canal is the crus simplex of the horizontal canal. Above this point and near the posterior surface of the pyramid is the crus communis of the two vertical canals.



The canals communicate with the utricle by means of five openings.

As above stated, the two vestibular apparatuses normally exert a certain influence over the nuclei of the eye muscle nerves. Just what this influence is and just how it is exerted is not thoroughly understood. Whether the stimulus results from movements of the hairs composing the cupolas, or whether it is a constant force exerted by the vestibular apparatus as a whole and independent of any such movement is not known. I have also mentioned that a disturbance in the equilibrium of the influence exerted by the two sides results in vestibular nystagmus. For example, if one labyrinth is accidentally destroyed during a radical mastoid operation, the influence exerted by the vestibular apparatus of the injured side is removed so that the healthy side acts alone. Being accustomed to acting with the vestibular apparatus of the injured side, the healthy side over acts, as it were, the moment the other side ceases to functionate. The result is a sudden and marked vestibular nystagmus to the healthy side.

#### TURNING NYSTAGMUS.

Turning nystagmus may best be explained by first giving a short description of Ewald's experiment upon pigeons.

The right horizontal semicircular canal (VII-6) is exposed by dissection. A short distance posterior to the ampulla an opening is made in the osseous canal and the canal completely plugged. (See A in accompanying diagram.) Between this point and the ampulla a second opening is made in the bony canal. To this opening is attached a small pneumatic hammer controlled by a rubber bag and tube (B in diagram). By means of this hammer the membranous canal may be compressed or released by compressing the air in the bag or aspirating air from the tube into the bag. Now the canal being completely closed at A posteriorly, the endolymph can flow in but one direction upon compression and in but one direction upon aspiration. In other words, it must flow, upon compression, toward the ampulla (C) and utricle (D); upon aspiration, from the utricle and ampulla back to the canal. Upon compression (the right canal being used for the test) there occurs a slow horizontal movement of the head and



eyes to the left, which corresponds to a horizontal nystagmus to the right. Upon aspiration there occurs a slow movement of the eyes and head to the right corresponding to a horizontal nystagmus to the left. This experiment demonstrates the dependence of definitely directed eye and head movements upon the direction of the flow of endolymph in a definite semicircular canal. The same experiment may be made with the anterior and posterior vertical canals, the resulting movement in each case being in the same plane as the canal tested.

Under normal conditions, a movement of endolymph in the semicircular canals resulting in a reflex nystagmus occurs when an individual is turned in one direction a number of times. For example, if an individual with head erect is placed in a revolving chair and turned to the right, in the beginning the endolymph remains still while the canals turn to the right, this amounting to a flow of endolymph from the canal toward the ampulla and utriculus in the case of the right horizontal canal. Now, if the turning is continued even for a few seconds the endolymph accompanies the canal in its movement to the right. The movement from the canal to the utriculus in the beginning is, however, sufficient to cause, during the turning, a horizontal nystagmus with the rapid component to the right. The endolymph in the left canal is, in the beginning, flowing in the opposite direction, that is, from the utriculus toward the canal. This proves that the movement of the hairs of the crista ampullaris toward the utriculus caused by the flow of endolymph in that direction is the physiologically more active movement. If the turning is now suddenly stopped the endolymph continues its movement for a moment from the utriculus to the canal in the right canal, whereas the canal itself remains still. In the left canal at the same time the flow is from the canal toward the utriculus; this latter being the physiologically more active direction, the nystagmus is now to the left.\*

These experiments prove beyond all doubt that turning nystagmus is the result of ampullary hair movements, the direction being dependent upon the flow of endolymph.

So-called compression nystagmus, seen in cases of fistula of the labyrinth wall, may be explained in the same way.

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\*By changing the position of the head all forms of vestibular nystagmus, including rotatory, vertical, horizontal, and combinations of the three, may be caused.

## CALORIC NYSTAGMUS.

Caloric nystagmus may be explained in the following manner:

If cold water is injected into the right ear of an individual possessing an intact vestibular apparatus, there occurs, when the head is erect, a rotatory nystagmus to the left. If instead, water above the body temperature is used, there results a rotatory nystagmus to the right. If the right ear is syringed with cold water and the head is bent forward and downward  $180^\circ$  so that the crown points toward the floor, there occurs a rotatory nystagmus to the right side. Syringing with hot water, then, has the same effect as bending the head downward  $180^\circ$  after syringing with cold water. The explanation of this, according to Barany, is as follows: When an ear is syringed with cold water, the endolymph nearest the lateral wall of the vestibular apparatus sinks as a result of that portion of the labyrinth being reduced in temperature. This sinking of endolymph results in a definite endolymph flow, which in turn causes movements of the ampullary hairs and thus finally nystagmus. Hot water in causing the endolymph to rise results in a flow in the opposite direction, and in nystagmus in the opposite direction to that caused by cold water. Now syringing the right ear with cold water (head erect) results in a rotatory nystagmus to the left, because with head erect the summit of the anterior vertical canal forms the highest point in the labyrinth, while its ampulla is in close relation to the lateral wall. When the latter is syringed with cold water the endolymph in the anterior vertical canal will move from the summit toward the ampulla. The same endolymph movement may be caused by bending the head toward the left shoulder. This results in rotatory nystagmus to the left. In the same manner, cold water, when syringed in right ear (head erect), causes rotatory nystagmus to the left.\*

If the right ear is syringed with cold water and the head bent upon the left shoulder there results a horizontal nystagmus to the right. If the head is inclined toward the right

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\*With the head bent forward and downward 180 degrees the summit of the anterior vertical canal becomes the lowest point in the labyrinth. In this position cold water results in a flow of endolymph from ampulla to summit and rotatory nystagmus to the side tested.

shoulder there results a horizontal nystagmus to the left. This is explained in the following manner: By bending the head toward the left shoulder we place the horizontal canals in a vertical position. The summit of the arch of the right horizontal canal now forms the highest point in the right labyrinth. The ampulla lies just median to the lateral wall. If this wall is now syringed with cold water, the endolymph moves from the summit toward the ampulla. This same movement is obtained by turning an individual, head erect, to the right. This, we know, results in horizontal nystagmus to the right. In the same manner horizontal nystagmus to the right results from syringing the right ear with cold water, the head being bent upon the left shoulder. With the head bent toward the right shoulder the ampulla of the right horizontal canal is higher than the arch, so that syringing with cold water in this position will result in nystagmus to the left.

#### GALVANIC NYSTAGMUS.

The explanation of galvanic nystagmus is as follows:

Application of the kathode to the right ear results in katelectrotonus of the affected nerves. This acts as an irritant, and in addition increases the conducting power of the nerves so that from the periphery the normal stimuli become strengthened. The stimuli, conducted from the right vestibular apparatus to the eye muscle nerves, being now greater than the normal stimuli from the left side, a nystagmus to the right results.

The anode, when applied to the right ear, results in the nerve condition called anelectrotonus, which decreases the conducting power of nerves, so that from the periphery fewer stimuli reach the nuclei of the eye muscle nerves. In this condition the stimuli conducted from the left vestibular apparatus will be greater than those from the right. The result is a nystagmus to the left side. Application of the anode to the left ear, of course, results in nystagmus to the right.

Whether the galvanic current acts upon the peripheral endings of the vestibular nerve, upon its trunk, or directly upon Deiter's nucleus in the medulla is not known. The probability is that either Deiter's nucleus or the vestibular nerve trunk is directly affected as the same reaction, above described, has been obtained in a case where the vestibular apparatus of the side tested had been previously removed by operation.

## SUMMARY.

1. The vestibular apparatuses exert a certain influence over the eye muscles.

2. This influence or stimulation is conducted through the vestibular nerves to Deiter's nucleus in the medulla.

3. From Deiter's nucleus of each side the stimuli are carried through the fasciculus longitudinalis posterior to the abducens and oculomotor nuclei of both sides, the cross fibers conducting the greater stimulation. From the four nuclei of the eye muscle nerves the stimuli are conducted to the eyes.

4. Normally the influence exerted by the two vestibular apparatuses is the same.

5. Any disturbance in the equilibrium of the influence exerted by the two sides, whether it be an increased stimulation from the one side or a diminished stimulation from the other, results in nystagmus.

6. Turning, caloric, and compression nystagmus are all the result of definite ampullary hair movements caused by endolymph flow.

7. Vestibular nystagmus has two components, a slow and a rapid. The slow component results from vestibular action, the rapid is voluntary and originates in the gyrus angularis of the cerebral cortex.

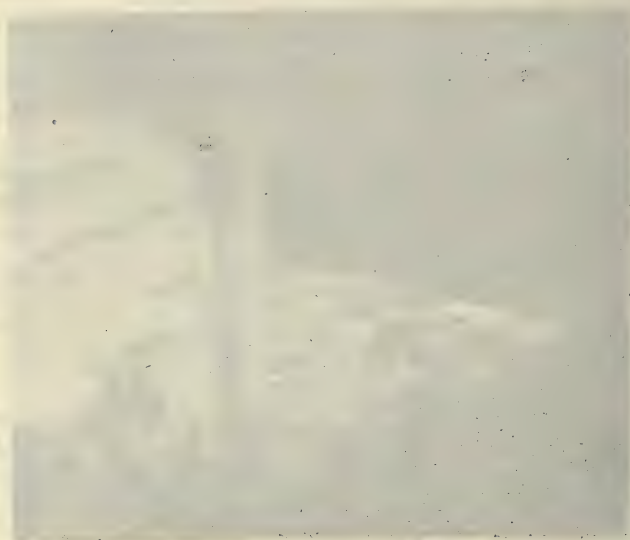
Metropolitan Building.





375 2

FIGURE I.



PLATE

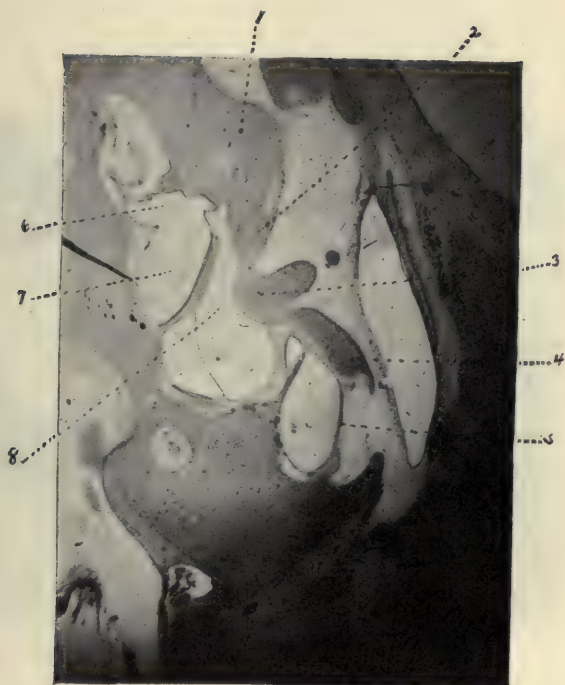
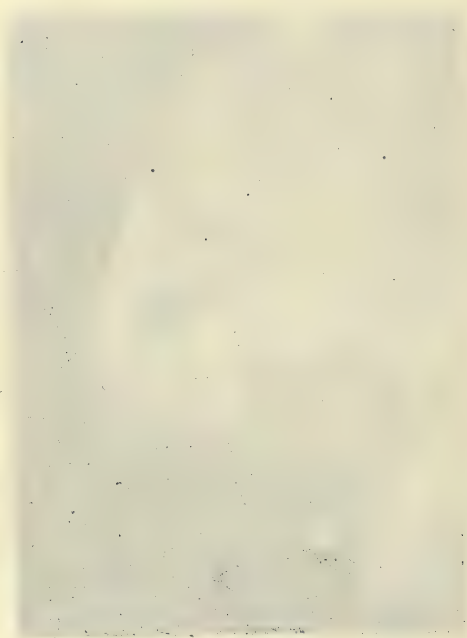


FIGURE 2.



1885



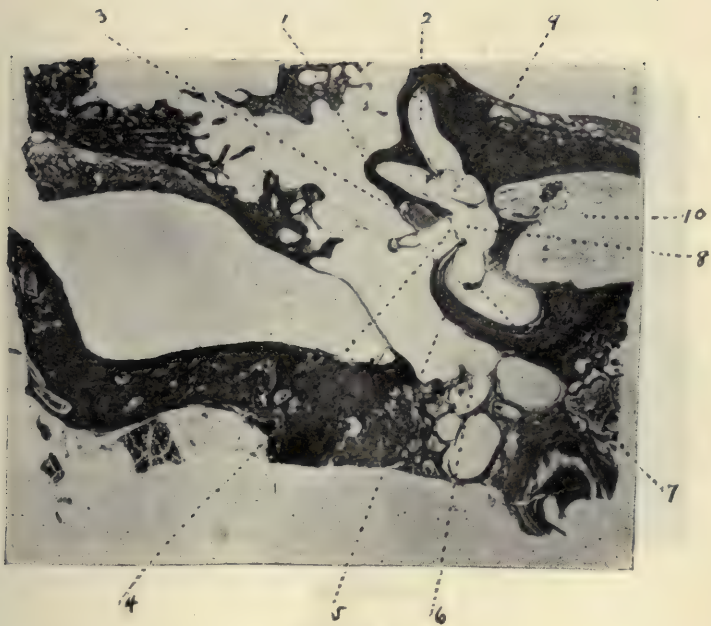


FIGURE 3.





FIGURE 4.





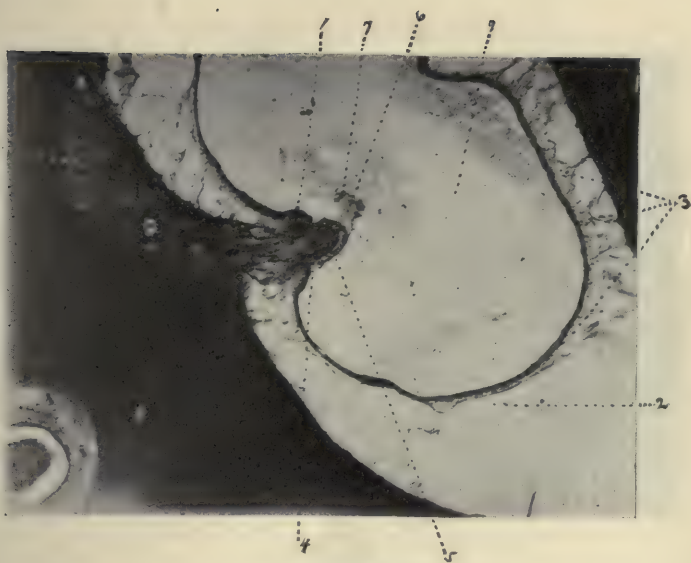


FIGURE 5.



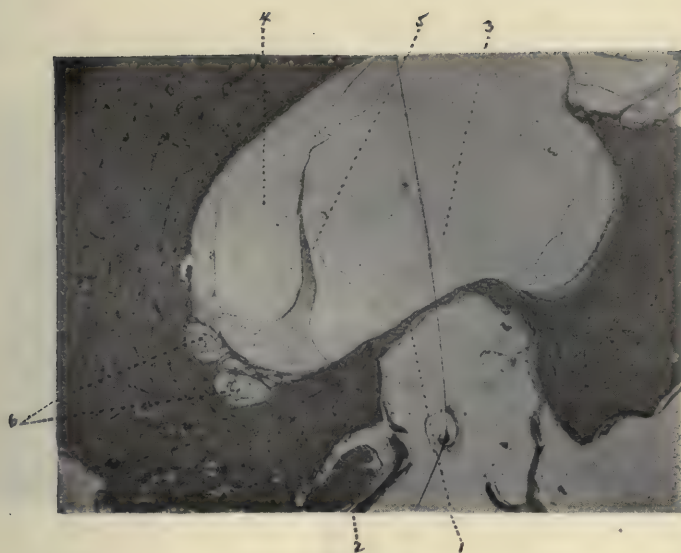


FIGURE 6.





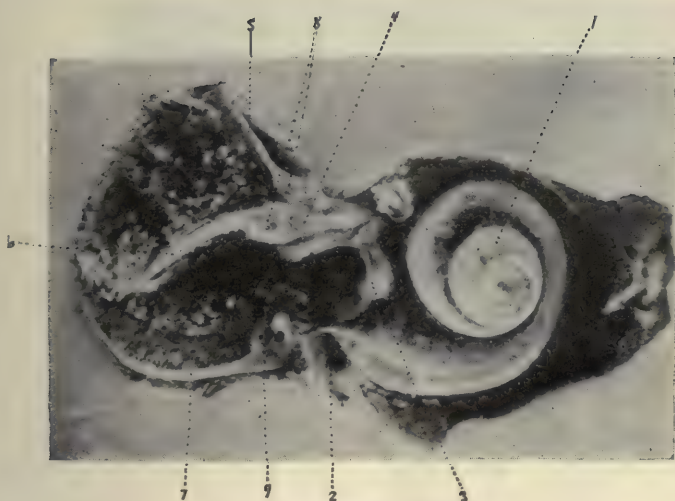


FIGURE 7.



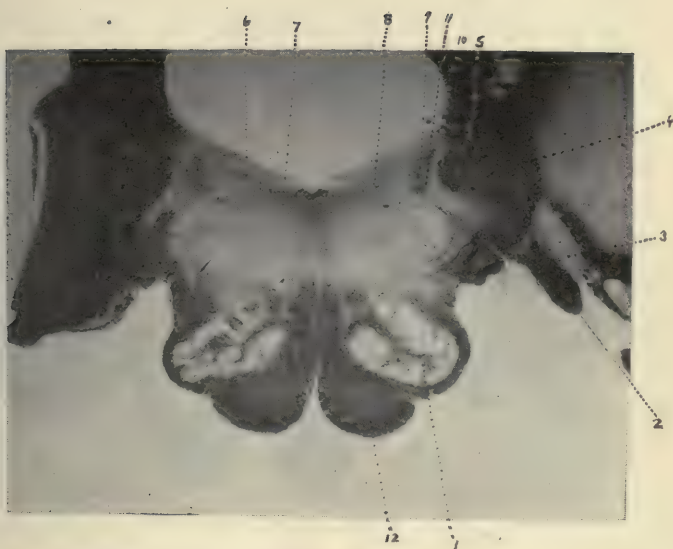


FIGURE A.





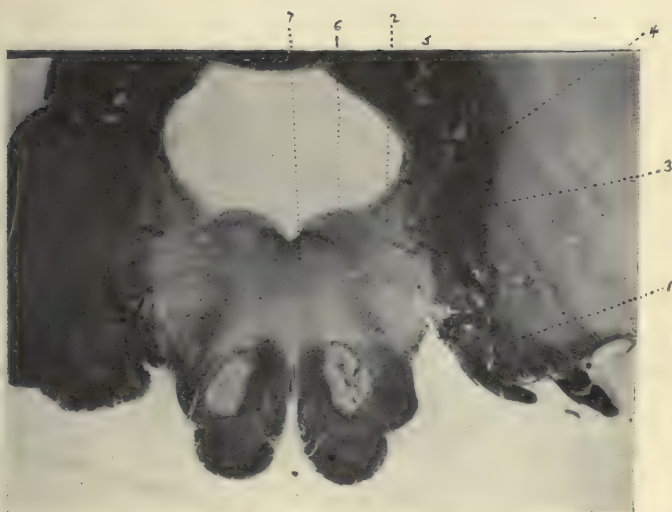
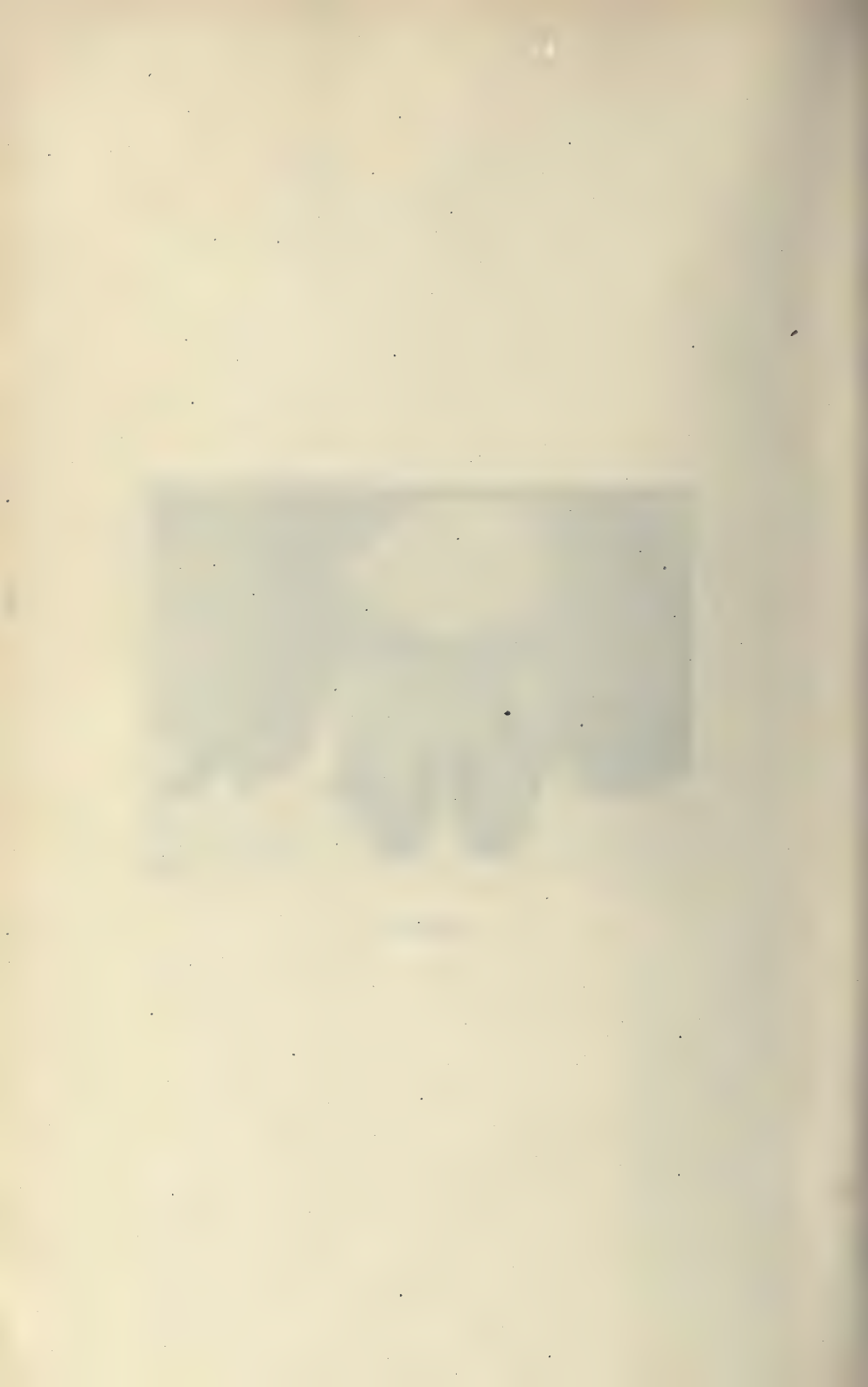


FIGURE B.



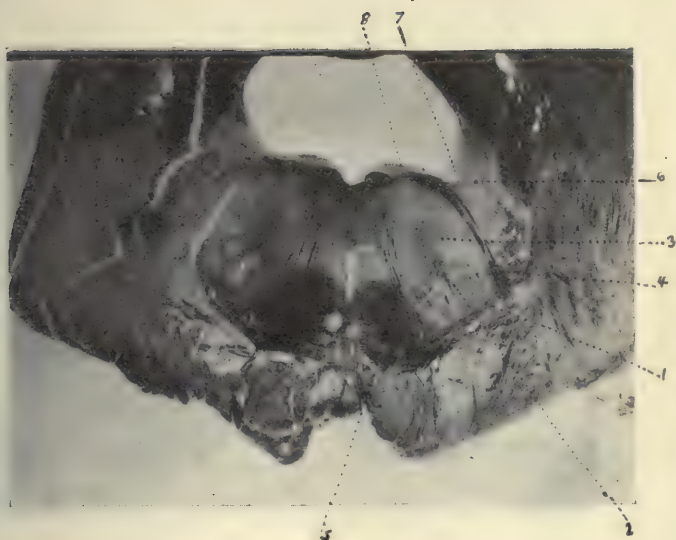


FIGURE C.





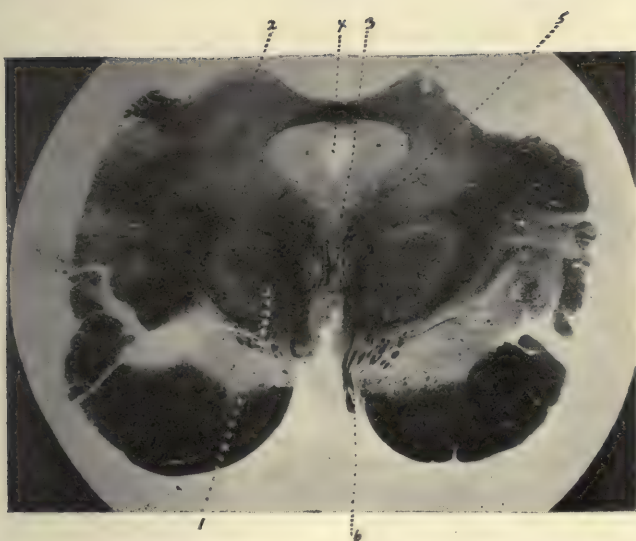
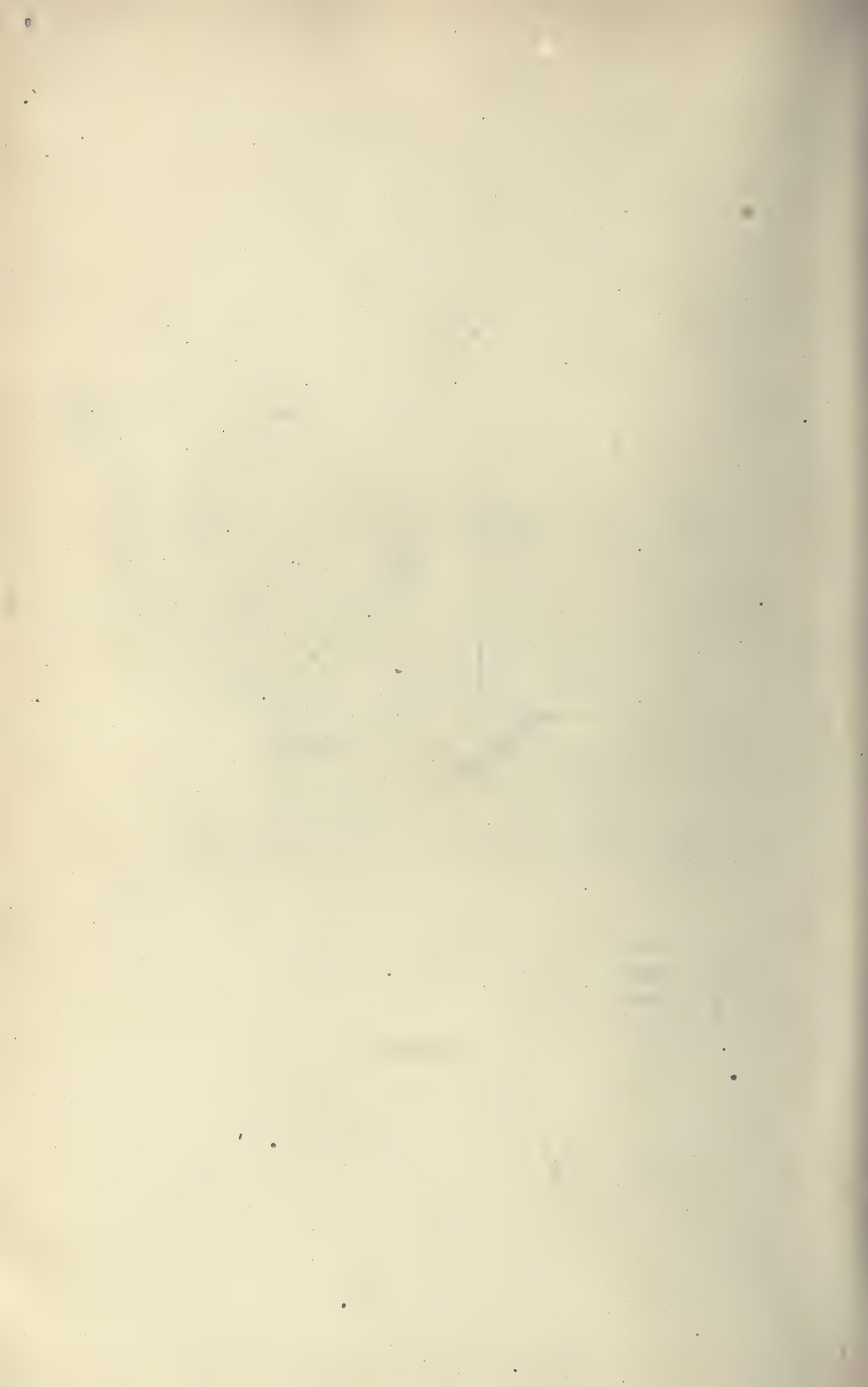


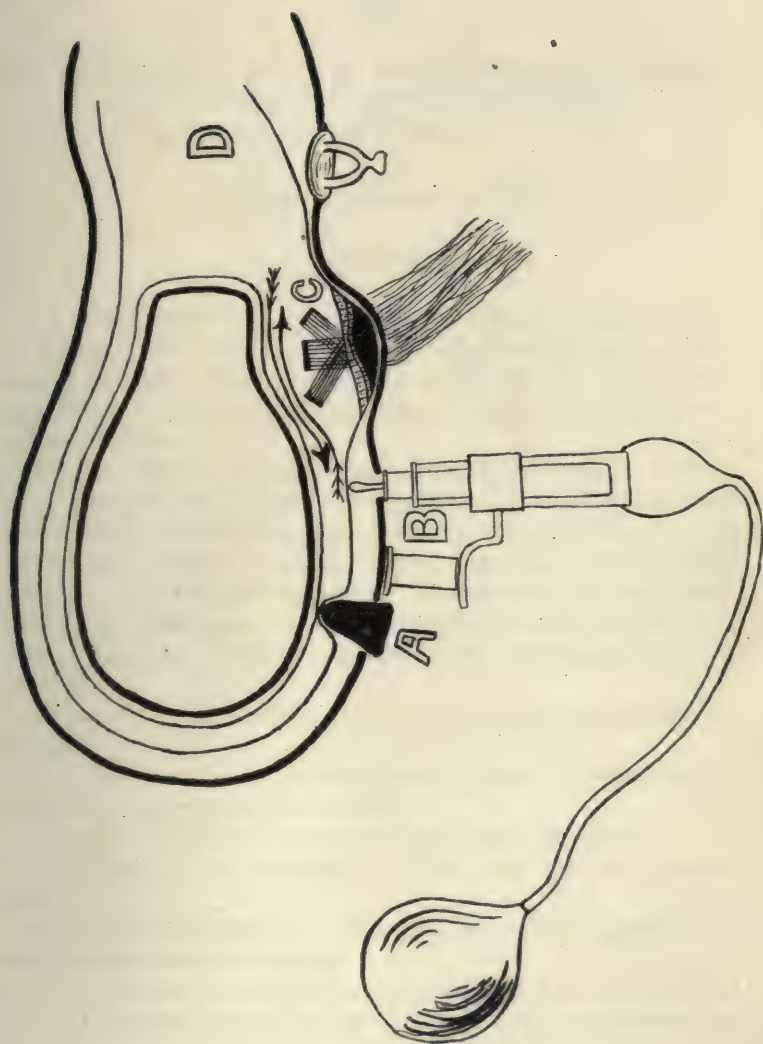
FIGURE D.











EWALD'S EXPERIMENT.



## LXII.

### AN INVESTIGATION OF POSTOPERATIVE CONDITIONS FIVE TO TEN YEARS AFTER INTUBATION.

BY BURT R. SHURLY, M. D.,

DETROIT.

An investigation into the results of surgical work, five, ten or fifteen years afterward, proves most fascinating and valuable. Medical literature does not afford, so far as the writer can determine, a record of postoperative conditions some years after intubation.

As the results of many operations are reported immediately after the work is done, it may be of interest to enumerate some of the observations after Dame Nature and Father Time have poured their soothing syrup over the surgical field. The object of this investigation is to determine the later after-effects of intubation, laryngeal diphtheria and antitoxin (if any) upon the structures of the upper respiratory tract in particular.

A series of interesting problems is at once presented for analysis.

1. Does intubation produce scar tissue or predispose to pathologic change in the larynx?
2. Are there late sequelae of laryngeal diphtheria?
3. What is the condition of the tonsillar or lymphoid ring?
4. What are the effects on the general susceptibility of the parts to other infections?
5. Are there any remote effects from the antitoxin used?
6. Is intubation ever followed by laryngeal paralysis of any variety, or by any impairment of phonation?

To answer these questions authoritatively would require a larger series of observations than these cases afford. It is possible, however, to obtain facts that will hold true in general.

Laryngeal diphtheria is more prevalent in our city among the ignorant, unsanitary foreigners, who live upon unpaved streets in thickly settled communities.

The difficulties of locating patients five to twelve years after operation is much greater than would be anticipated. Of a carefully recorded series of 437 intubations for laryngeal diphtheria, eighty per cent of whom were alive when the tube was removed, I have been able to locate and examine at the present writing thirty of the older cases.

Among superstitious and ignorant people the dread of a doctor's office is both apparent and ridiculous. Apprehension and mental panic can often be depicted in those individuals where the family physician, as such, is unknown; where the children are controlled by fear, and it is, therefore, difficult for them voluntarily to submit to examination.

The patients were reached (when possible) by earnest personal solicitation, by mail, by telephone or by messenger. In these observations a definite plan was followed. The method of examination included a reference to a detailed record, which was made at the time of operation, and to a series of ten simple questions, as follows:

1. From what illness has your child suffered since operation?
2. Has the child suffered from hoarseness at any time?
3. What throat trouble has been present?
4. Can the child breathe through the nose?
5. If not, what adenoid or other obstructive symptoms are present?
6. Have any diseases of childhood developed since operation?
7. Has any chest or ear trouble developed?
8. Does the child catch cold more easily since the attack of diphtheria?
9. Has the child had enlarged glands of the neck?
10. Has the child had shortness of breath, asthma or hay fever?

The usual examination of the nose, throat and larynx by means of the full office equipment was then made. In addition to this, any other family history of importance was sought for. The complete case report in detail is as follows:

Case 1. E. E., present age 18 years; intubated March 26,



1897; laryngeal diphtheria; six days since first appearance of exudate; doses of antitoxin, 2,500 units; tube removed 97 hours after; sequelae, none; other cases in family, none.

Result of examination twelve years later, March 5, 1909—Mild atrophic rhinitis right side; posterior discharge; hypertrophic tonsil left side; adherent pillars postpharyngeal wall; laryngitis with areas of atrophy; buried tonsil—right—with adherent anterior pillar; some thickening of lateral walls; postnasal discharge; some adenoid remnants; series of sore throat and tonsillitis every winter; no hoarseness nor cough; two sessile adenoid papilla on the right of the median line in the region of the lingual tonsil, touching the anterior subglottic wall, size of the head of a tack; no asthma; no bronchitis; all chest conditions negative; chronic nasopharyngitis; no trouble during the summer; slight hypertrophy of the left postcervical chain of lymphatics. Tonsil operation advised.

Case 2. E. W., present age 17 years 3 months; intubated March 2, 1896; laryngeal diphtheria; antitoxin 1,000 units; tube removed 60 hours after; sequelae, none.

History since operation—Pneumonia two weeks in 1900; hoarseness occasionally in the fall; clears throat often; chokes before talking; no other throat trouble; no adenoid symptoms; does not catch cold easily; no asthma or shortness of breath; hypertrophy of thyroid; prominent sternocleidomastoid muscle.

Result of examination thirteen years later—Deflection upper third septum, first degree to the right. Spur cartilaginous anterior at the floor of the nose, left side. Granular pharyngitis; atrophic areas. Slight atrophic nasopharyngitis, in initial stage; throat never treated for any morbid condition; crescentic epiglottis; enlarged papillae; larynx slightly hyperemic; laryngoscopic examination difficult on account of neurotic condition. Shortening of the rim of the epiglottis, with deep clover-leaf cleft in the median line. Shortening of the aryepiglottic fold; no scar tissue visible.

Case 3. R. W. H., present age 14 years 3 months; intubated August 20, 1897; two days after first appearance of exudate; antitoxin 2,500 units; tube removed 96 hours after; no other case in family, but one across the street.

History since operation—Measles four years ago; chicken-pox, mild; no hoarseness or throat trouble; does not catch cold more easily.

Result of examination twelve years after—Slight hypertrophic rhinitis inferior and middle; very slight spur floor right septum; very slight pharyngitis, with areas of highly atrophic tissue between; slight enlargement of the right tonsil; adhesion of the pillars, with negative symptoms; some adenoid—central; hypertrophic rhinitis continued to the posterior ends—mild; large lingual tonsil; epiglottis small—normal; larynx normal; slightest fullness of the mucous membranes just below the interarytenoid fold.

Case 4. M. K., present age 15 years 5 months; intubated July 8, 1897; four days since first appearance of exudate; antitoxin 1,500 units; tube removed 98 hours after; sequelæ, none; other cases in family, none; considerable cough after removal of tube.

History since operation—Pneumonia two years ago, sick one week; slight enlargement of the left postcervical chain; otherwise negative.

Result of examination twelve years later—Slight anemia; deflected bony and cartilaginous septum right side, with almost complete occlusion. Moderately high arched palate; teeth regular; enlarged tonsils; crypts exuding cheesy material; chronic lacunar tonsillitis; some adenoid. Postrhinoscopic examination shows roomy, posterior openings, slight bony deflection, but not obstructive. Slight dry cough through the winter, but not in the summer. Subglottic region; on the anterior wall to the right of the median line is a slight elevation of the mucous membrane the size of the head of a tack; mucus between the cords, which are normal in color. Operation recommended.

Case 5. L. K., present age, 10 years; intubated February, 1900; antitoxin 3,000 units; tube removed 92 hours after.

History since operation—Had scarlet fever lasting ten days; no hoarseness; snores some at night; does not "catch cold" more easily; no chest or ear trouble; no asthma or shortness of breath; two very slightly enlarged glands (left).

Result of examination nine years later—Left nasal passage normal; anterior right inferior turbinate slightly intumescent; very slight deflection of the upper third of the cartilaginous septum; nonobstructive. No enlarged adenoid; tonsils normal; lingual tonsil normal; slight thickening of the crest of the epiglottis, especially the median third. Laryngoscopic image normal.

Case 6. E. S., present age, 18 years 1 month; intubated December 22, 1896; antitoxin 1,000 units; tube removed (coughed out) 72 hours after; sequelæ none; other cases in family, none.

History since operation—Measles a few weeks after the operation; no hoarseness; earache occasionally; took cold once this winter, but not especially predisposed; no asthma, hay fever or shortness of breath.

Result of examination thirteen years later—Anterior nares normal; no spurs or deflections; follicular pharyngitis; irritable throat; no hypertrophy of cervical glands; slight acute nasopharyngitis, otherwise normal; epiglottis normal except injected with the coryza; laryngeal appearances are normal.

Case 7. J. A., age 19 years 2 months; intubated February 8, 1897; six days since first appearance of exudate; antitoxin 1500 units; tube coughed out nineteen hours after, reinserted two days later; sequelæ none; other cases in family, one brother.

History since operation—Has not seen a doctor since. Sore throat last week, but not before this time. None of the diseases of childhood.

Result of examination twelve years later—Acute coryza; intumescent turbinates; acute pharyngitis and nasopharyngitis; slight hyperemia of tonsils; follicles swollen and mucous membrane injected; small amount of mucus over post-inferior turbinate; membrane to right of median line one-eighth of an inch below interarytenoid space; good view down to bifurcation; membrane normal; cords without scar; epiglottis normal.

Case 8. E. F., present age, 13 years 9 months; intubated August 9, 1909; three days since first appearance of exudate; antitoxin 1,500 units; tube removed sixty hours after.

History since operation—Measles at 6 years; cold and cough most of the time, with expectoration usually; slight laryngitis at present, "but not for a long time" before; sore throat and tonsils swollen twice since; croupy a good deal of the time. Never been able to breathe through nose since; snores at night; "catches cold" more easily; no asthma nor shortness of breath.

Result of examination nine years later—Nasal passages roomy; slight spur; cartilaginous and bony, left; small de-



flection at the floor, anteriorly; postnasal discharge every morning; hypertrophic lacunar tonsillitis, with very large inflamed crypts; inferior laryngeal wall atrophic; mucopurulent secretion; large adenoid in median line, with additional portion to the right of the median line the size of one-half the uvula; left posterior inferior turbinate hypertrophic and intumescent; cervical glands normal; croupy cough at present; lingual tonsil enlarged; upper laryngeal area above the vocal cords hyperemic and slightly swollen; film of mucus between the cords; small layer of mucus on the anterior laryngeal wall one-quarter of an inch below the vocal cords; roughness of interarytenoid fold. Operation recommended.

Case 9. E. Q., present age, 11 years 10 months; intubated October 4, 1899; five days after first appearance of exudate; antitoxin 4,000 units; other cases in family, none.

History since operation—Bronchitis and hoarseness every winter until two years ago; cannot breathe through nose well and cannot blow nose well; measles, mumps, and chicken-pox since; trouble with right ear two years later; "catches cold" more easily since operation; no enlarged glands; for eight years had "asthma" at night (probably adenoids). Operation advised.

Result of examination nine years later—No enlarged cervical glands; thick crust over turbinate, left; roomy nasal passages; slight cartilaginous spur, anterior; moderately high arched palate; no crowded teeth; throat red; tonsils not enlarged, ragged in appearance; slight papillary eminence at the junction of the uvula and anterior pillar, left side. Moderately enlarged adenoid glands, central mass; tonsils adherent to the pillars; appearance of extensive old inflammatory condition; clears throat a great deal; epiglottis rather thick, not abnormal; laryngeal examination difficult. Adenectomy advised.

Case 10. R. E., present age, 17 years 7 months; intubated November 5, 1899; first appearance of exudate (tonsils) two weeks, larynx three days; antitoxin 2,500 units; other cases in family, one; sequelæ, none.

History since operation—Had scarlet fever; acute laryngitis four days last winter; one attack of bronchitis; does not "catch cold" more easily; lower jaw prominent.

Result of examination ten years later—Symmetrical devia-



tion of septum, left; right nostril roomy and normal; hard palate somewhat high arched; uvula smaller than normal and triangular in shape; chronic lacunar tonsillitis; crypts large, without cheesy deposits; posterior pillars thickened, extend into the uvula; left tonsil hypertrophied slightly; right tonsil adherent and not protruding beyond the pillars; nasopharynx, very slight amount of adenoid tissue. Rhinoscopic picture normal; epiglottis slightly more hyperemic than normal, slightly roughened, with fine papillæ. Impossible to get a view further down than the top of the arytenoids, which seemed normal. Very slight enlargement of the anterior cervical glands.

Case 11. A. L., present age, 15 years; intubated November 7, 1899; four days since first appearance of exudate; antitoxin 2,000 units; tube removed 108 hours after; sequelæ none; other cases in family, none.

History since operation—Measles about a year after; no hoarseness; clears throat some; does not catch cold more easily; has attacks of "nose bleeding"; no enlarged glands, excepting with a "cold."

Result of examination ten years later—Slight bony cartilaginous ridge, left; good breathing space anteriorly; right anterior view normal; chronic hypertrophic lacunar tonsillitis; central adenoid with mucopurulent secretion extending over the vomer; otherwise rhinoscopic picture normal, very slight thickening of mucous membrane just to the left of the median line on the lower border of the interarytenoid fold. Vocal cords normal. A view down to the bifurcation. Tracheal wall rather dry; no evidences of scar tissue in subglottic region. Adenectomy advisable.

Case 12. E. K., present age, 14 years; intubated November 2, 1900; five days after first appearance of exudate; antitoxin 2500 units; tube removed 96 hours after; sequelæ, none; no other case in the family.

History since operation—Sore throat every winter since; no doctor since; slight huskiness of voice; no diseases of childhood since; does not "catch cold" more easily; no enlarged glands, no asthma nor shortness of breath.

Result of examination nine years later—Slight cartilaginous spur, right; otherwise, anterior view of both nostrils normal; chronic hypertrophic lacunar tonsillitis; slightly hypertrophic adenoid covered with mucopurulent secretion; slightly en-

larged lingual tonsil; laryngoscopic image normal, except for slight thickening of the vocal cords; no hyperemia; no scars apparent; uvula normal; laryngeal wall bathed with mucus.

Case 13. L. K., present age, 12 years 11 months; intubated April, 1900; antitoxin 2500 units; sequelæ, none; tube removed 96 hours after.

History since operation—No diseases of childhood; voice husky at times during winter; hard breathing at night (winter), snoring some; prominent teeth, upper jaw crowded with teeth; catches cold more easily since; no enlarged glands; no asthma nor shortness of breath; one year later, another child in the family died of nasal diphtheria.

Result of examination nine years later—Teeth crowded; high arched palate; deflection of septum, cartilaginous; breathing room—fair left side; anterior nasal passages (right) normal anteriorly; large central adenoid bathed in secretion; hypertrophic chronic lacunar tonsillitis; mouth breather. Distance between tonsils about three-eighths of an inch; adherent at pillars; glands of posterior cervical chain, left, slightly enlarged; lingual tonsil large; upper border of epiglottis median line curled over and thickened; hyperemic condition of the larynx; thickening of the interarytenoid fold; vocal cords normal; no scar tissue apparent. Operation advised.

Case 14. E. K., present age, 11 years 10 months; intubated November 11, 1898; thirty-six hours after first appearance of exudate; antitoxin 3,000 units; no other cases in family.

History since operation—Had whooping cough the summer after operation; German measles at six years of age; hoarseness continued for a year after the operation; breathes through nose; conjunctivitis after antitoxin; "inflammation of the lungs" twice—soon after; "sickly for a year." Discharge from ear three months before operation, none since; does not "catch cold" more easily since; no enlarged glands; no asthma nor shortness of breath.

Result of examination ten years later, March 27, 1909—Anterior nasal view normal, excepting slight thickening of cartilaginous septum—right side; slight fissure on the floor of nose at the juncture of the skin and mucous membrane, from which there has been a series of expistaxes; pharyngoscopic view normal; postrhinoscopic view shows slight chronic nasopharyngitis with the posterior wall bathed with mucopus; adenoid

tissue very slightly enlarged; very slight enlargement of the postcervical chain of glands more on the right than the left side; arytenoid cartilage smaller than normal; larynx smaller than normal; child developing; clears throat before speaking; voice breaks on the first word frequently; vocal cords smaller than normal; larynx seemed rather dry; no scars visible; mucus between the vocal cords; subglottic region bathed with mucus; interarytenoid fold normal (smooth).

Case 15. E. G., present age 12 years; intubated November 22, 1898.

History since operation—Stuttered ever since operation; tonsillitis every winter; no hoarseness; breathes through nose; earache for four days, three weeks ago; had three "colds" this winter; stops stammering when he takes a short breath and then speaks. Makes a hissing sound when stammering.

Result of examination nine years later—Slight enlargement of cervical glands; small cartilaginous spur anterior (left); slight deflection of upper third of cartilaginous bony septum (right). Palate arched more than normal; one large central pharyngeal follicle; "buried tonsils" with pathologic crypts; mucus in the nasopharynx; adherent tonsils to anterior and posterior pillars; patient has collar tic; central adenoid extending down over the posterior wall; posterior nares normal; very large lingual tonsil, filling the region between the tongue and epiglottis; no cough; anterior tracheal wall bathed with mucus, no scars visible; no proliferations; larynx slightly hyperemic; film of mucus between the vocal cords in the region of the anterior commissure; otherwise normal; atrophic areas on the posterior pharyngeal wall. Operation refused.

Case 16. W. P., present age 14 years; intubated March 19, 1898; three days after first appearance of exudate; antitoxin 2,000 units; tube removed 124 hours after; sequelae none; a fatal case in the house (downstairs) a year before.

History since operation—Had hoarseness two months after tube was taken out, none since; breathes through nose; none of the diseases of childhood; discharge from ear twice, all right now, hearing good; does not "catch cold" more easily; no enlarged glands; no asthma, nor shortness of breath.

Result of examination eleven years after—Anterior nasal region normal; slight fullness of the cartilaginous septum; some dryness of the nasal mucous membrane; very large ton-



sils; large central adenoid that extends down the posterior wall of the nasopharynx; not many "colds;" clears throat a good deal; breathes through nose; no deflected septum; no mouth-breathing; examination difficult on account of tonsils coming together, much gagging; larynx shows no scar tissue; hyperemia of the larynx; lingual tonsil very much enlarged; posterior wall of the epiglottis bathed with mucus. Operation advised.

Case 17. F. S., present age 15½ years; intubated February 21, 1900.

History since operation—None of the diseases of childhood; no hoarseness; has had shortness of breath; "colds" occasionally—recovering quickly; no chest or ear trouble.

Result of examination nine years later—Dyspnea, not now as much as three years ago; remnant of adenoid; some coryza; hyperemia of inferior turbinates and moderate intumescence; small amount of mucopus in nasopharynx; pharyngeal wall shiny and without follicles; atrophic in appearance; larynx normal but hyperemic; no scars; vocal cords normal; trachea is visible for an inch.

Case 18. G. P., present age 12 years 2 months; intubated October 2, 1909; thirty-six hours after first appearance of exudate; antitoxin 2,500 units; tube removed 108 hours after.

History since operation—"Colds" and sore throat; curvature of the spine; tonsillitis this winter; snores at night, but breathes all right; no enlarged glands; no asthma, hay fever, nor shortness of breath.

Result of examination ten years later—Anterior nares normal; enlarged adenoid; chronic lacunar tonsillitis; larynx hyperemic; no scars; mother died seven years ago during parturition; father died last June of carcinoma of the stomach. Operation advised.

Case 19. D. G., present age 14 years; intubated December 2, 1896; two days after first appearance of exudate; antitoxin 1,500 units; tube removed 96 hours after; sequelae none; no other cases in the family.

History since operation—Had measles some years ago; no hoarseness; no throat trouble; no ear or chest trouble; no enlarged glands; no asthma, hay fever, nor shortness of breath.



Result of examination twelve years later—Very narrow nasal passage—left with some thickening and deflection of the septum at the base; right nasal passage wider than normal; papillomatous eminence at the junction of the anterior fold of the pillar and uvular fold on either side and symmetrically; tongue stubborn; small adenoid bathed with mucus; slightly enlarged lingual tonsil, cauliflower formation made up of a large number of little papillomatous excrescences and touching the epiglottis at a number of points; epiglottis small; larynx slightly hyperemic; laryngeal image normal.

Case 20. G. H., present age 14 years 11 months; intubated October 22, 1899; two days after first appearance of exudate; antitoxin 1,500 units; tube removed 96 hours after; no other cases in family.

History since operation—Had measles two years after; mumps every winter; hoarseness every winter, sometimes expectorates blood; sore throat, tonsils swelling; tonsillitis every winter; "catches cold" more easily; had four "hard colds" this winter; has enlarged glands, which the patient calls mumps; no shortness of breath, asthma or hay fever.

Result of examination nine years later—Nose, anterior normal; slight hypertrophy of follicles of pharynx; hypertrophy (moderate) of tonsils, especially right; slightly enlarged adenoid with rugae; larynx normal; arytenoids small, larynx developing; child just developed. Operation advised.

Case 21. H. S., present age 11 years 2 months; intubated January, 1901; seven days after first appearance of exudate; antitoxin; tube removed 116 hours after; no other cases in family.

History since operation—Had chickenpox, no doctor since; hoarse for two weeks, no other throat trouble; breathes through nose; "catches cold" more easily; has cough with any cold; no enlarged glands; no asthma; no shortness of breath nor hay fever.

Result of examination eight years later—Slight cartilaginous knob (anterior) at the floor of nose, otherwise normal, left; right side anteriorly normal, slight enlargement of lymphatic postcervical chain (left and right); teeth widely separated and even; small uvula; tonsils normal; slightly anemic; mild follicular pharyngitis; nasopharynx normal; laryngeal image normal, excepting hyperemic through crying; "slight cold"

for a few days lately; pharynx hyperemic; tonsils buried and normal.

Case 22. C. V., present age 16 years; intubated October, 1897; antitoxin.

History since operation—Had measles, mumps, chicken-pox and influenza; sore throat and la grippe every winter, treated at first with salt pork, if not better, gets doctor, usually once during winter; cough with "colds" usually, no discharge from ears; no asthma; no hay fever nor shortness of breath.

Result of examination twelve years later—Slight cartilaginous spur (left); right nasal passage normal, excepting mucopurulent discharge from posterior entrance. Chronic lacunar tonsillitis, buried and adherent tonsils, giving the appearance of much old inflammation; central adenoid is shrinking; posterior hypertrophies of the septum; posterior nares normal; slight thickening at the interarytenoid fold; slight scar on the anterior wall of larynx; vocal cords very dry, film of mucus between the vocal cords; adenoid remnants give appearance of hypertrophy in earlier life; chronic lacunar tonsillitis, with mucopurulent discharge from the nasopharynx; granular pharyngitis; little areas of atrophy. Operation advisable.

Case 23. G. J., present age 9 years; intubated December 14, 1904; seven days after first appearance of exudate; antitoxin; tube removed 48 hours later; replaced and removed the fifth day. No other case in the family.

History since operation—None of the other diseases of childhood; had no doctor since; continuous hoarseness, sometimes quite marked; "catches cold" more easily; no asthma, nor shortness of breath nor hay fever.

Result of examination in five years later—Eczema left nostril with mucopurulent discharge; right turbinate intumescent; "cold all winter." Tonsils and larynx examined by Dr. E. L. Shurly and myself; normal to all appearances. Huskiness due to muscular or nervous insufficiency. Nasopharynx, remnant of adenoid; three patali of adenoid on left anterior surface of nasopharyngeal anterior wall, a fingernail breadth above pillars; tonsils buried; no lingual hypertrophy.

Case 24. R. H., present age 12 years, 5 months; intubated December 31, 1902; five days after first appearance of exudate; antitoxin 2,000 units; no other cases in the family.

History since operation—Had stiff neck or "rheumatism"

for one week; no hoarseness; cannot breathe through nose very well; high arched palate; none of the other diseases of childhood; one very small gland—right side; no asthma, nor hay fever nor shortness of breath.

Result of examination six years later—Slight deflection of nasal septum—right; chronic follicular pharyngitis; moderate enlargement of central adenoid—not sufficient for operation; slight amount of hypertrophy of lingual tonsil; epiglottis narrow, long and thin; larynx normal; patient of slender build, but “wiry.”

Case 25. E. M., present age 11 years; intubated May 31, 1903.

History since operation—Has not had any illness or trouble of consequence since; some hoarseness for a month after; breathes through nose all right; no other diseases of childhood; does not “catch cold” more easily; two or three small enlarged cervical glands; no asthma, hay fever, nor shortness of breath.

Result of examination six years later—Slight deflection of nasal septum (left); nasal passage roomy, though; slight adenoid enlargement; faucial tonsils quite large and irregular; pharynx and upper larynx rather red; epiglottis quite pointed; arytenoids on uneven plane; vocal cords all right—but wet; trachea normal; no scar, no flattening of larynx.

Case 26. E. W., present age 23 years; intubated November 14, 1907; antitoxin 3,500 units; tube removed 78 hours after; sequelae, paralysis; no other cases in the family.

History since operation—Had mumps two years ago; one attack of hoarseness three years ago; breathes through nose all right; no other diseases of childhood; slightly enlarged cervical glands; tonsillitis every winter until having diphtheria, none since.

Result of examination twelve years after—Cartilaginous spur left; bleeding point on the anterior end inferior turbinate; right anterior turbinate swollen; high arched palate; chronic lacunar tonsillitis; cheesy deposit in the upper crypts; anemic pharyngeal wall and somewhat atrophic; slightly enlarged adenoid tissue of right faucial tonsil, none of the left; all nasopharyngeal paralysis complication past; diphtheritic cast of trachea removed before operation; very slight enlargement of postcervical glands; did have enlarged glands of anterior



right side—lower set—but these have almost faded away. Slight adenoid, shrinking; thickening of the septum posteriorly; absolutely no throat symptoms except clearing the throat, occasionally; lingual blood vessels enlarged; epiglottis smaller than average; vocal cords slightly dry; slight thickening of the opposite parts of the vocal cords at the posterior third; trachea bathed in mucus; slight atrophic areas.

Case 27. C. M., present age 16 years, 9 months; intubated July 11, 1897. First appearance of exudate on tonsils, two weeks after, and larynx two days after; antitoxin 1,000 units; tube removed 96 hours after; no other cases in the family; sequelae, bronchopneumonia.

History since operation—Had not had any illness since; no other diseases of childhood; no hoarseness; no asthma nor hay fever.

Result of examination eleven years later—Slight extra dryness of mucous membrane with crust formation; slight atrophic rhinitis with crusts; marked atrophic pharyngitis; tonsils slightly enlarged; clears throat often; pharynx bathed in mucus; some slight enlargement of the postcervical chain (left); epiglottis very erect and small; roomy spaces in lingual tonsillar region; vocal cords slightly dry; tracheal rings very prominent; larynx otherwise normal; the opening bounded by the arytenoids slightly smaller than average.

Case 28. W. G., present age 15 years, 7 months; intubated January 18, 1897; nine days after first appearance of exudate (tonsils); croupous two days; antitoxin 2,000 units; tube removed 96 hours after; one other case in family, and one next door.

History since operation—Had scarlet fever at eight years of age; mumps shortly after that; rheumatism last year, very lame now, uses a cane to walk; tendons of right foot contracted; mouth breather part of time; tonsillitis just before rheumatism, lasting a month; no ear trouble since diphtheria, when purulent otitis med. developed; does not "catch cold" more easily; three moderately enlarged postcervical glands (left).

Result of examination twelve years later—Anemic; had rheumatism; lately, again; septum straight; middle turbinate enlarged; anemic appearance of mucous membrane; right side deflection of nasal septum, in upper third; slight cartilaginous



spur anteriorly, lower turbinate and along floor; tonsils buried; faucial pillars markedly adherent anteriorly and posteriorly; atrophic pharyngitis; adenoid glands bathed with mucopus; very small choanae; large erect epiglottis; arytenoids small; tracheal wall atrophic; large larynx; vocal cords flabby; upper part of the larynx normal; vocal cords injected and appear as if epithelium were changed, pearly white color is lost; grayish, red and streaked, instead they are large, flat and flabby.

Case 29. M. R., present age 13 years, 8 months; intubated May 31, 1897; thirty-six hours after first appearance of exudate; antitoxin 2,000 units; no other case in the family.

History since operation—Had measles eight years ago; whooping cough seven years ago; has chronic conjunctivitis; no hoarseness; "sore throat often;" snores, is restless; dry cough most of the time; catches cold more easily; two moderately enlarged cervical glands (left); no asthma, nor shortness of breath, except with so-called "catarrh;" operation recommended.

Result of examination twelve years later—Anterior nasal passages on the left side roomy; posteriorly there is pus on the middle turbinate; the inferior turbinate shows marked intumescence plugging the right passage, large amount of thin mucopurulent secretion. Hypertrophy of both tonsils with marked adhesion to the anterior and posterior pillars. Two calcareous flat patches not rising above the surface, on both vocal cords, beginning about one-sixteenth of an inch from the anterior commissure. Arytenoids slightly swollen; no scars visible; the tonsil concretions removed with the laryngoscopic mirror during examination. Operation advised.

Case 30. M. McK., present age 16 years, 2 months; intubated January 27, 1897; three days after first appearance of exudate; antitoxin 1,500 units; tube removed 124 hours after; no sequelae.

History since operation—Had measles at six years of age; one cold each winter; dry cough since last winter; breathes through nose all right; does not catch cold more easily; no asthma, shortness of breath nor hay fever.

Result of examination twelve years later—Slightly intumescent right inferior turbinate; good nasal breathing; slight cartilaginous spur (right side), nonobstructive; crowded teeth;

tonsils not projecting beyond posterior pillar; slight follicular enlargement of posterior pharyngeal wall; adherent tonsils throughout entire posterior border; anterior free; right tonsil somewhat smaller than the left. No history of tonsillitis or other inflammatory conditions since. Posterior choanae small, normal passage; slight mucous discharge, nonpathologic; no adenoid hypertrophy. Slight thickening of lingual tonsil. Hyperemic arytenoids. No scar on the cords nor interarytenoid folds; trachea normal.

#### SUMMARY OF EXAMINATION.

Of the thirty cases examined all had clinical laryngeal diphtheria.

The age varied at operation from seventeen months, the youngest, to eleven years, the oldest.

The smallest dose of antitoxin given was one thousand units; the largest four thousand units.

The time during which the tube was worn consecutively was from forty-eight hours to one hundred and twenty-four hours.

No instance of retained tube occurred in any of these cases. Four cases required reintubation.

In one case intubation had been attempted by two other operators during some hours, without success.

Other cases of diphtheria appeared in the same family or in the neighborhood, from which the contagion could be traced in five of these cases.

The subsequent statements show the extent of susceptibility of infectious or contagious diseases in these cases, as follows: Measles, ten cases; chickenpox, four cases; mumps, four cases; whooping cough, two cases; scarlet fever, three cases.

Partial or complete aphonia remained from one day to seven years after the removal of the tube.

"Throat disease" was claimed in ten cases.

Four cases were partial, periodic or complete mouth-breathers.

Other adenoid symptoms were present in six cases.

Lung or heart disease was noted in six cases.

Affections of the ears were acknowledged by four.

A greater susceptibility to coryza was observed in seven cases.

Dyspnea, asthma or hay fever in two cases (from adenoids).

The examination was made five years after intubation in one case, and from eight to twelve years later in the other cases.

Nasal conditions requiring operation—Deflected septum, four; intumescent and hypertrophied turbinates, two.

Nasopharyngeal conditions requiring operation—Adenoids, six cases.

Pharyngeal conditions requiring operation—Eight cases (tonsils).

Laryngeal conditions requiring operation—None.

Enlarged cervical glands were found in nine cases.

Thickening of the interarytenoid fold was observed in four cases.

#### CONCLUSIONS.

Every case in this series was intubated for laryngeal diphtheria.

1. Intubation in laryngeal diphtheria is required more frequently where marked tonsillar hypertrophy exists.

2. Pathologic adenoid and tonsils are prominent predisposing factors in diphtheritic infections of the larynx.

3. No deleterious effects of antitoxin were noted.

4. Laryngeal paralysis is extremely rare after intubation.

5. Little attention is often given by the physician or patient to nasal obstruction until serious damage results to the general health.

6. Numerous pathologic conditions of the upper respiratory tract may exist without symptoms or annoyance.

7. Scar tissue was observed in two cases. The cicatrix was insignificant and apparently produced no modification in function.

8. No case of laryngeal paralysis was found, although one with motor insufficiency was observed.

9. The pathologic effects of diphtheria on the tonsillar ring are numerous and aggravated.

10. Children developing laryngeal diphtheria show a marked tendency to other infections in childhood.

11. So-called chronic catarrhal inflammation of the upper respiratory tract is usual after severe diphtheria.

### LXIII.

## A CASE OF PURULENT PACHYMEINGITIS WITH EXTRADURAL ABSCESS, SUBDURAL ABSCESS, AND SEPTIC THROMBOSIS OF THE LAT- ERAL SINUS, COMPLICATING CHRON- IC SUPPURATIVE MIDDLE EAR DISEASE.

BY JAMES J. CARROLL, A. M., M. D.

BALTIMORE.

Of recent years the publication of intracranial disease of otitic origin has been so frequent, it is with feelings of an apologist that the writer adds another to the rather long list of such cases in medical literature. However, as subdural suppuration is one of the least common results of otitis media, it may not be without interest to refer briefly to this rare complication and to cite a case in point which came under observation three years ago, and ended in complete recovery.

Suppuration, extending from the temporal bone to the subdural space, encounters a wonderfully good barrier to disease in the dura. How long this membrane may hold out against purulent inflammation it is impossible to say. But the evidence furnished by a number of cases of extradural abscess, met with in mastoid disease, would go to show that a pachymeningitis externa may last quite a little while. The pathologic process becomes more active, however, when the dura perforates and the suppuration passes to the inner side. If unchecked the pus will quickly invade the meshes of the pia or the substance of the brain. Occasionally the suppuration becomes circumscribed and the pus confined by adhesions between dura and arachnoid, giving rise to a subdural abscess. It is hardly conceivable, however, that such a condition could last long before the pus would attack the pia mater. Consequently a localized subdural suppuration, unaccompanied by either cerebral abscess or general leptomeningitis, must be looked upon as rare.



The first cases of subdural abscess seems to have been reported by Ceci and Onetti<sup>1</sup> in 1886. An abstract of this case was given by von Bergmann<sup>2</sup> in 1899, in the third edition of his book on the surgical treatment of diseases of the brain. Four cases were described by Macewen<sup>3</sup> in 1893. Subsequent ones have been published by Jansen,<sup>4</sup> Delstancie,<sup>5</sup> Milbury,<sup>6</sup> Leiszynski,<sup>7</sup> Lucae,<sup>8</sup> Meier,<sup>9</sup> Suckstorff and Henrici,<sup>10</sup> Manasse,<sup>11</sup> Hald,<sup>12</sup> and others. In some instances the condition has been described as a localized purulent meningitis. In the third edition of his book Körner<sup>13</sup> makes reference to sixteen cases. Heine,<sup>14</sup> in the second edition of his book on operations on the ear, cites three cases, all having been previously published, two in the Lucae Festschrift, 1905, and one in the *Verhandlungen der Otologischer Gesellschaft*, 1903.

The following is the writer's case, which was brought before the Ophthalmological and Otological section of the Baltimore City Medical Society, January, 1908:

F. C., female, 18 years old, had a left otorrhea since an attack of scarlet fever when three years of age. During the 15 years of her otorrhea she had several so-called "gathered ears." On April 24, 1907, patient was taken with pain in the left ear and headache; on the following day, nausea and vomiting. On the third day she had a chill at 4 a. m. and another at 9 a. m., each followed by profuse sweating. Dr. Geo. Hartman, in whose practice the case occurred, asked me to see her on the fifth day, April 29. Her general appearance then was that of a very sick person, with marked anemia, clammy perspiration over the forehead, some emaciation, drowsiness, coated tongue, temperature 101, rapid pulse. Patient was suffering with severe headache, which was increased by moving the head. In the left external meatus there was a small amount of foul-smelling pus. Posterosuperior wall was sunken, and obstructed very much the view of the drum. There was no redness or swelling over the mastoid, but considerable tenderness on pressure. Pain was caused by pressing upon the neck just below the tip of the mastoid process. There was slight enlargement of the glands along the sternocleidomastoid. Hearing, which had been impaired in the left ear for a long time, had become much worse during present illness. Diagnosis was an acute exacerbation of a chronic

mastoiditis with involvement of the lateral sinus. Immediate operation was advised. Patient entered St. Joseph's Hospital about 7:30 a. m., April 30th. Temperature 103 3-5, leucocytes 14,500. Urine free from albumin and sugar. Operation 9 a. m. same day under ether. Pathologic conditions presenting themselves were about as follows: Very slight subcutaneous infiltration; little free pus in fossa mastoidea; periosteum intact except over a small fistula in the cortex just behind the spina sprameatum; cortex very hard and thick, in places 7 to 8 mm. in thickness. Part of the inner plate of cortex was necrotic. There was no external wall to the antrum, which was filled with pus, necrotic granulations and cholesteatoma. Entire tympanum, including attic, filled with similar material. Roof of tympanum as well as antrum was pretty high, the bone fairly soft, but no fistula visible. Bone of the sigmoid sulcus seemed quite normal. Nowhere was dura or sinus exposed by disease, the location of the latter being rather far back. Posterosuperior wall was removed down to attic. Incisions in skin were not sewn up tight, and the usual skin flaps in the external meatus were omitted, because patient suddenly collapsed under anesthetic, and nothing was further attempted than the adjusting of the usual surgical dressings. Patient's general condition the next morning was fair, neck soft, not painful on pressure. Complained, however, of headache, had a short hacking cough without expectoration, and a rather staring expression about the eyes. Temperature that day ranged from 101 to 105½; pulse full, easily compressible and wanting tone. About 9 p. m. she had convulsive twitchings of the face and arms for five minutes, both sides being equally affected, according to the nurse. Resident physician responded to hurry call almost immediately and found patient semiconscious and pupils dilated. I saw patient myself about an hour afterwards. She was then perfectly conscious, and answered all questions intelligently. There was no aphasia. Movements of eyes, pupillary reflexes and eye grounds were normal; power of voluntary muscles of arms and legs was complete; surface sensibility good, and skin reflexes normal. During night, however, patient had no power over bowels or bladder, voiding both involuntarily. Four ounces of normal salt solution and ½ ounce whiskey were given every two hours by rectum. Next morning, May

2d, patient complained of severe pain in the left ear and left side of the head. About 11 a. m. she felt chilly without having a positive rigor. This was followed by temperature  $105\frac{1}{2}$ , which dropped in three hours to 100, no profuse sweating taking place, though skin was moist. There was still the short hacking cough, without expectoration, and chest sounds were normal. At 3 p. m. the same day patient was put to sleep, with a view of uncovering the lateral sinus.

The mastoid wound cavity looked well, was granulating and apparently free from pus. Bone covering sinus was hard, of good color and free from fistula. There was no fistulous opening visible in the roof of the tympanum. In the vault of the wound cavity, corresponding to the roof of the antrum, was a defect in the bone about 4 by 5 mm. Dura here seemed quite good. With this as a starting point about two-thirds of the entire roof of the pyramid was removed, leaving the most medially situated one-third in situ. The removal of bone above and slightly anterior to the knee of the lateral sinus, revealed a large area of green gangrenous dura. Here pus was seen welling up between bone and dura. This extradural abscess was quite large, necessitating the removal of a good piece of the squamosa and the lower corner of the parietal bone. The dura was so altered in appearance that it was impossible to distinguish the dividing line between dura of middle fossa and that of posterior fossa or between dura of posterior fossa and sinus wall. In the center of this gangrenous dura was a fistula, emitting a small jet of pus with each pulsation of the brain. This fistula was enlarged with scissors, and a grooved director passed without resistance backwards and inwards into a more or less walled-off cavity, which seemed to be, judging from the anatomic relations of the parts and the fairly good view I got with my head mirror, the upper surface of the tentorium. After this subdural abscess had emptied itself the lips of the opening were held apart by a piece of gauze. Gauze was also placed between bone and dura. On the supposition that the subdural abscess was probably at the bottom of the entire trouble, patient was returned to bed without uncovering the sinus. Unfortunately no bacteriologic examination of the pus from the dural abscesses was made. For the next three days patient's general condition was quite good, appetite improved, color much better and



temperature ranged from 98 2-5 to 100½. She complained still of pain in the left ear and head. At 2 p. m. the following day, May 6th, she had a mild chill, followed by temperature of 105½. Eye grounds showed nothing pathologic. Although patient's general condition was much improved and the leucocyte count had fallen to 8,500, it was quite evident that all sources of infection were not removed and that the sinus, which was the original object of attack, but from which we had been diverted by finding pus accumulations on either side of the dura, was contributing a large share to the pathologic process. So on May 8th patient was again put to sleep. Two posterior skin incisions were made, one a continuation of the one made at the first operation, the second running up and backwards over knee of sinus. Dura was further uncovered upwards about 12 mm. and backwards the same distance. There was a smear of pus over surface of this portion of dura. The dura uncovered at the previous operation was now firmer. The fistula had entirely healed, the dura at that point being a little more prominent than surrounding parts. This little ballooning of dura was quite suspicious of pus retention, but the dura itself had improved so much in appearance that it was deemed wise not to reopen the fistula. The sigmoid sulcus, which was normal in color at previous operations, was now dark, and its removal, exposed necrotic sinus wall, which enclosed throughout the entire length of the sigmoid curve a completely obstructing thrombus. The upper part of the thrombus plugged the sinus as high up as the knee, the lower portion plugged the vessel as low as the jugular bulb, while the middle part had disintegrated and formed a pus cavity which was only very imperfectly drained by a fistula through the sinus wall at the junction of the vertical and horizontal limbs. After the sinus wall was opened widely most of its interior was black with a film of gray over its inner surface. When the soft central portion of the thrombus was curetted away there was no bleeding from either end of the opened vessel. As the thrombotic plugs, which filled the median and distal ends of the sinus, were quite firm and seemed securely held in position, it was thought inadvisable to disturb them. A small tongue of bone on the roof of the petrosa corresponding to the course of the superior petrosal sinus was left in place to support the



brain. The opened sinus was packed lightly with iodoform gauze, as were also tympanum and canal; dura covered with gauze and wound left open. After this operation temperature became normal in 24 hours and remained so. The severe pains in the head ceased almost immediately, while those of the ear gradually subsided. Patient made a slow but good recovery, and at this writing is enjoying perfect health.

The case presents quite an array of interesting phenomena. Beginning with an otitis media from scarlet fever, the inflammation during fifteen years gradually invaded the mastoid with formation of cholesteatomatous masses in both tympanum and antrum. An acute exacerbation of a latent mastoiditis produced the illness which brought patient under observation. The most conspicuous symptoms at the first examination were those of mastoiditis, with septic thrombosis of the lateral sinus, and upon these the diagnosis of sinus complication was made. Sinus symptoms were practically unaffected by the exenteration of the mastoid and the opening of the dural abscesses. Severe head pains, usually in the left temporal region, but occasionally frontal, continued, together with chills and sudden elevations of temperature, until the sinus was opened and drained. That the systemic disturbance was not greater was probably due to the sealing of the lower portion of the sinus by a firm plug, preventing in this way the septic matter of the pus cavity in the middle of the thrombus passing en masse into the internal jugular. Whether or not there was any pathogenic cocci in the circulating blood was not determined, as no blood culture was made.

At the first operation it was our intention to investigate the condition of the sinus, but the unexpected collapse of the patient just after the mastoid cavity had been cleaned out rendered this impossible. At the second operation we were turned aside from the sinus partly by the normal appearance of the bone of the sigmoid sulcus and partly by finding the dural abscesses and wrongly attributing the clinical phenomena wholly to the subdural suppuration. In passing we may say that the case furnishes additional evidence of the pretty generally recognized fact in otology, that it is quite possible to have a destructive thrombophlebitis of the lateral sinus without a visible osteitis or necrosis of the sigmoid sulcus. It will be remembered that the bone over the sigmoid sinus was quite nor-

mal in appearance at the first and second operations, although the vessel was probably completely thrombosed at the time. Between the second and the third operation the appearance of the sigmoid groove changed materially, the purulent condition of the sinus wall beneath at last affecting the overlying bone. When the sinus was widely opened and the disintegrating center of the thrombus curetted away, the lumen of the incised vessel was so securely closed by plugs at both the median and the distal extremities that it was deemed unnecessary to remove them. Though it might have been safer to have ligated the jugular and then to have dislodged all portions of the obstructing thrombus, the recovery of the patient goes to show that ligation of the jugular is not absolutely necessary in every instance of complete obstruction.

The pachymeningitis was most likely the result of direct extension, the infection passing probably through the roof of the mastoid antrum. The suppuration was no doubt localized at first, giving rise to the extradural abscess. Contact of this collection of pus gradually softened the dura, which in time broke down, allowing the products of suppuration to pass to the inner side. How long the pachymeningitis interna had existed, it is impossible to say, but probably not long before it was arrested by free opening of the dura and drainage. The abscesses on either side of the dura were found united by a small fistula.

An interesting inquiry is whether the subdural suppuration gave rise to any clinical evidence at all. The only symptom referable to that cause was the short convulsion which occurred thirty hours after the first operation. A causal connection between the two is, however, by no means certain. In the present state of our knowledge of subdural abscess, it is safe to say that there is no pathognomonic sign of this condition, and that the diagnosis of such is made only at time of operation. Spinal puncture may be of assistance. Politzer says that as symptoms of circumscribed pachymeningitis interna are so similar to leptomeningitis, the dural sac should in the event of a negative spinal puncture be exposed and opened to prevent a diffused leptomeningitis.

With so much pus-laden dura in the vicinity of the superior petrosal sinus, one can hardly imagine how it escaped. If there was any involvement at all of this sinus, it was not de-

tected. On the day after the third operation both conjunctivae, especially the left, became injected, making one think of a possible beginning of the cavernous sinus. The eye grounds, however, were negative and the external appearance of the eyes returned to the normal in four or five days. That the labyrinth was not invaded is quite probable, as none of the usual symptoms were observed.

The recovery of this patient and of the majority of the cases already published and referred to in this paper would go to show that while subdural abscess is a grave complication of middle ear disease, it is far from being hopeless and may be completely cured by timely surgical interference.

512 Professional Building.

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## LXIV.

# FROM THE ANNUAL REPORT OF THE SANATORIA FOR TUBERCULOSIS IN THE UNITED STATES OF AMERICA AND CANADA.

BY J. W. GLEITSMANN, M. D.,

NEW YORK.

The great majority of the numerous sanatoria for tuberculosis in America issue no annual reports, and the reports issued by such institutions have only a limited circulation. By means of private inquiry, and especially through the friendly assistance of Dr. Jacobs, the secretary of the National Association for the Study and Prevention of Tuberculosis, a large number of these institutions was reached and thirty-two reports have, up to the present time (March 31, 1910), been received from them, among them the report of the U.S. Government. They do not all cover the same points nor end with the same months, and include varying periods of time, as all these institutions do not issue annual reports. The sanatoria are arranged according to the situation of the States in which they are located. Those classified under the name "State Sanatorium" are maintained by the State government and accept as a rule only poorer residents after an examination by a medical authority, who gives his opinion as to the prognosis, only curable cases and those in which a marked improvement is considered possible, being eligible. The name of the doctor is given in parenthesis. It was aimed to make this report as brief as possible, but in view of the fact that it is the first of its kind, it was considered desirable, in addition to data as to special equipment and therapeutic measures, to add information as to position, capacity, etc., points that can be omitted in later reports.

### CANADA.

1. GRAVENHURST (Ontario).—Muskoka Cottage Sanatorium and Muskoka Free Hospital for Consumptives (Dr. W.



B. Kendall). Eleventh annual report, September 30, 1907 to 1908. Both institutions on the lake of the same name, erected by and under the control of the National Sanatorium Association of Canada. The first named institution has room for 85 pay patients, lies in a park of 75 acres, has a main building with offices, three sun parlors, dining room, and rooms for 27 patients. There are in addition six cottages and ten tents. Of 220 patients, 128 stayed longer than one month, and of these (in the first and second stages) 41 were apparently cured or the disease was arrested. The second institution, for 75 patients without means, was recently increased by 32 beds. Of 172 patients in first and second stages who stayed longer than six weeks, 108 were apparently cured or the progress of the disease arrested.

2. HAMILTON (Ontario).—Mountain Sanatorium (Dr. J. H. Holbrook). Under the control of the Hamilton Health Association. Fifth annual report, September 30, 1908-1909. Main building with offices, dining hall, a shack each for men and women, a third in course of construction. Capacity, 40 patients. Of 98 patients discharged during the year, having remained longer than one month in the institution; of 31 in the first stage, 19; of 22 in the second stage, 11—were apparently cured or disease arrested.

3. TORONTO (Ontario).—Toronto Free Hospital for Consumptives and King Edward Sanatorium for Consumptives (Dr. W. J. Dobbie). These are the only two institutions in Canada which take advanced cases. The King Edward Sanatorium is for pay patients at moderate prices, and was opened Sept. 30, 1907. It consists of three buildings, administration, hospital, dining room with kitchen. Fifty-four patients have been admitted. The Toronto Free Hospital shows in its fourth annual report (1907-08) that 168 patients were received, 157 discharged, 54 improved. No one of these was in the initial stage, and, under the circumstances, the results were satisfactory.

#### VERMONT.

4. PITTSFORD.—Vermont Sanatorium (Dr. W. C. Klotz). Second annual report, 1909. Public sanatorium for early cases; others accepted if there is room. Capacity, 40 patients; price, \$7.50 a week. Situated in the Green Mountains; 250 acres of wooded land; one main building, two cottages con-

nected with it by corridors. A third cottage, erected in 1909, rooms facing south. One hundred and eighteen patients treated during the year; 83 discharged, 37 of them in first stage, 18 apparently cured, 17 improved; 43 in the second stage, 4 apparently cured, 18 improved; 49 patients stayed longer than three months; 15 of them in the first stage, 13 of these apparently cured, in 2 disease arrested; 33 in second stage, 3 apparently cured, 14 disease arrested; of these last patients 12 were treated with tuberculin.

#### MASSACHUSETTS.

5. RUTLAND.—Massachusetts State Sanatorium (Dr. Fred L. Hills). Twelfth annual report, November 30, 1907-08. The first institution of its kind erected by a state. Elevation, 1,200 feet; accommodates 350. Radiating from the main building facing south and connected with it by corridors, are situated pavilions, including a sun parlor. Average number of patients, 339; average stay, 6 months 22 days. Of the total number of 619 patients, 16% apparently cured, 38% disease arrested; of 230 early cases, 33% apparently cured, 46% disease arrested; of 312 in second stage, 8% apparently cured, 37% disease arrested. Tuberculin frequently used for diagnosis, bouillon filtrate therapeutically. In the laboratory, investigation of such subjects as metabolism, opsonins, vaccines, etc. Inquiry as to the condition of the 4,311 patients treated up to December, 1907, gave the following results: 32.9% no answers, 26.7% died, 36.5% able to work, 3.6% not able to work.

6. SHARON.—Sharon Sanatorium (Dr. Walter A. Griffin). Eighteenth annual report, December 1, 1907-08. For women with moderate means in early stage. Elevation 300 feet; 150 acres; capacity, 23. A main building with southern exposure, with balconies on which the patients can sleep at nights. Of 40 patients discharged during the year, 19 apparently cured, 11, disease arrested. A number treated with tuberculin.

#### RHODE ISLAND.

7. WALLUM LAKE.—State Sanatorium (Dr. Harry Lee Barnes). Fourth annual report, 1908. On lake of same name. Capacity, 120; elevation, 600 feet; 250 acres. A main build-

ing, connected with it by corridors, two large buildings for patients, with sun parlors. The average duration of the stay of the 249 patients discharged during the year was 5 months and 20 days; 26 apparently cured, 73 disease arrested; 151 patients remained from 3 to 34 months; 20 of these in first stage; 13 apparently cured, 5 disease arrested; 119 in second stage, 13 apparently cured, 54 disease arrested. Tuberculin used for diagnostic and for therapeutic purposes. Inquiry showed that 32% of patients discharged in 1906, 37.6% of those discharged in 1907, and 86.5% of those last year were apparently cured or much improved and able to work.

## CONNECTICUT.

8. HARTFORD.—Wildwood Sanatorium (Dr. Wm. B. Bartlett). Opened in 1905; annual report September 30, 1908-09. Connected with Hartford Hospital. Accommodates 50 patients in early stage. The institution lies high, consists of a main building, on each side of which is a ward for 25 men and 25 women, respectively, with a balcony on which the patients' beds may be rolled out for the night. During the year 115 patients were treated; 111 discharged; 10 of these apparently cured, 30 much improved. In a few cases Deny's tuberculin was used with good results.

9. WALLINGFORD.—Gaylor Farm Sanatorium (Dr. D. R. Lyman). Fifth annual report, May 1, 1908-09. Established by the New Haven County Association; accommodates 65 patients. Of the patients, 20% may be advanced cases. Elevation, 390 feet; 304 acres, 20 used as farm land. Main building, 4 cottages, with protected balconies on which the beds are placed. Of the 121 patients discharged during the year, 88 had remained longer than three months, and of 79 in the first and second stages 5 apparently cured, 43 disease arrested. Tuberculin treatment of 29 patients who stayed three months or longer gave good results. Inquiry as to the present condition of the patients treated from September, 1904, to January, 1909, gave the following gratifying results: Of 374 patients, 83% of the early cases, 56% of those in the second stage and 12% of the advanced cases were without subjective symptoms and able to be at their work.



## NEW YORK.

10. RAY BROOK (Adirondack Mountains).—New York State Hospital for the Treatment of Incipient Pulmonary Tuberculosis (Dr. Albert H. Garvin). Eighth annual report for the year 1908. Elevation, 1,625 feet; present capacity, 164. The waiting list is larger than the number of patients, and an increase in the number of beds to 300 is very necessary. Area of more than 500 acres; large adjacent forests. There is an administration building, on each side of this a sleeping pavilion and two smaller buildings. Of 298 patients, 217 stayed longer than three months; 99 apparently cured, 62 disease arrested. Treatment consists of proper diet, exercise and fresh air, the details having been given in a former report.

11. LAKE KUSHAGUA (Adirondack Mountains).—Stony Wold Sanatorium (Dr. Hy. S. Goodall). Eighth report, for the year 1908. Plans for 150 patients; present capacity, 95. For women in early stage and for a limited number of children, for whom there is a school. During the year 22 children as patients. Near the lake, spacious grounds, with orchards and vegetable gardens. Main building, with offices, dining room, two large sleeping chambers with 25 beds each. Three pavilions built during the last year, and a laboratory. Twenty lodges (members only women) help toward defraying the expenses. During the year 224 patients treated, 135 discharged, six of these without any demonstrable tuberculous lesion; of 105 women 53, of 24 children 19 apparently cured or disease arrested.

12. LIBERTY.—Loomis Sanatorium (Dr. H. M. King), named after the late well-known New York clinician Alfred L. Loomis. Thirteenth annual report, October 31, 1908-09. Elevation, 2,300 feet; just south of a range of hills, which afford protection. Three separate classes, varying in price; first the sanatorium proper, with a main office building, with parlors, a building for the reception and observation of new patients; second, a building for patients of the middle class, with 14 beds; third, patients unable to pay, with 40 beds. In the medical report attention is called to the necessity for, and the plans already made, for enlarging the laboratory and for increasing the facilities for investigative work. During the year work was done on the blood serum of tuberculous patients compared to that of healthy individuals, and on the chemistry and bac-



teriology of the secretions. Tuberculin treatment in a large number of cases gave good results. Of 205 patients in the first two divisions, 32 were apparently cured, in 44 disease arrested. Of 119 patients in the third class, 26 were apparently cured, in 35 disease arrested.

13. NEW YORK.—(a) Montefiore Home for Chronic Invalids (Dr. Siegfried Wachsman). Twenty-fifth annual report, September 30, 1908-09. Large stone building in a garden, taking in a city block, in the northern part of the city, which lies high. Free for chronic invalids; about 50 beds for tuberculosis patients. During the year 472 patients were treated; 57 of these consumptives, of whom 3 were apparently cured and 9 improved. The institution cannot accommodate even a small part of those who desire admission, and the erection of a larger building in the country is contemplated.

(b) BEDFORD STATION.—Montefiore County Sanatorium (Dr. J. Rosenberg). Opened 1897. Under the same direction as the above; 40 miles from New York. Elevation, 450 feet; 150 acres; capacity, 180; free for poor patients in incipient stage. Four two-story buildings, connected by corridors; southern exposure; sun parlor. During the year 512 patients were treated. Of 178 in the first stage, 29 were apparently cured, in 55 the disease arrested. Of 85 more advanced cases, 1 was apparently cured, 14 improved.

14. SARANAK LAKE.—Adirondack Cottage Sanatorium (Dr. E. L. Trudeau). Twenty-fifth annual report, October 31, 1908-09, together with a memorial celebrating the 25th year of its existence. (See end of paper.) This is no place for a complete history of the institution, but a few facts as to its early days will be interesting. The late Dr. Loomis was the first one to recognize the advantages of the climate of the Adirondacks, and it was he who persuaded Dr. Trudeau to settle there. He had at first three small wooden buildings accommodating 12 patients. The rooms were heated with small stoves and petroleum furnished the light. There are now 25 buildings, a main building, 21 cottages, hospital, and library, and 110 patients can be taken care of. Elevation, 1,650 feet; one mile from the lake; \$7 a week, and a fund to pay for free beds (37 patients last year). Through the liberality of the patrons a building has been added almost every year. A separate medical report gives the history of each case. During

the year 300 patients were treated, 190 discharged. Of these 38 were apparently cured, in 102 disease arrested, 37 improved. One hundred and sixty-four patients stayed longer than three months; of these 62 were in the first stage; 28 apparently cured, in 25 disease arrested. Of 97 in the second stage, 8 were apparently cured, in 63 the disease arrested. Of those who remained longer, 96 were treated with tuberculin; 32 in first stage, 11 apparently cured, in 17 disease arrested; 61 in second stage, 4 apparently cured, in 41 disease arrested. The report as to the present condition of 421 patients treated with tuberculin from 1901 to 1908, is as follows: The whereabouts of 79 unknown, 95 dead, 126 living, 192 well. Of 2,691 patients of the years 1885-1908, 1,041 are in good health, 308 living, 1,099 dead, 252 information lacking.

#### PENNSYLVANIA.

15. MONT ALTO.—State South Mountain Sanatorium (Dr. A. M. Rothrock). First annual report, May 31, 1907-08. Begun in 1907, after appropriation by State. Capacity, 350, but being enlarged for 250 more. Elevation, 1,600 feet; 500 acres; 41 buildings, each with 4 rooms, to accomodate two patients. Of 81 patients discharged during the year in the first and second stages, 37 were apparently cured, 35 improved. A serum prepared by Dr. Dixon, a State health officer, was used in a number of cases with good results.

16. SCRANTON. West Mountain Sanatorium. Sixth annual report, for 1908. Under the direction of the Scranton Society for the Prevention and Cure of Consumption. For poor of the city, free; for others, \$5 to \$7. Capacity, 24; 60 acres, under cultivation. Elevation, 1,500 feet; two walls, one for men and one for women, with ten beds each. Six shacks, each for two patients. Of 29 patients discharged during the year, 2 were apparently cured, 27 improved.

#### NORTH CAROLINA.

17. ASHEVILLE.—Winyah Sanatorium (Drs. Carl and Silvio v. Ruck). Report for 1907 and 1908. For 80 pay patients. Opened in 1888. Situated in a park. Elevation, 2,000 feet. Large main building of stone, with spacious porches on each of the two floors, which can be closed up neces-

sary. Well-equipped laboratory for investigative work and the preparation of the watery extract of tubercle bacilli used in the institution. Of 337 patients discharged during the two years, 75 were in the first stage; of these, 55 were apparently cured or improved; the same result occurred in 88 of 135 in the second stage, and 54 of 127 in the third stage, a total of 197. Of these 197, 159 were apparently cured, in 38 disease arrested. Average duration of treatment, 168 days. The following figures show the good results obtained with the above mentioned tuberculin preparation: Of 782 patients, from 1888 to 1898, without specific treatment, 11.9% were apparently cured, 30% improved; of 1,503 patients treated with the extract, 55.5% were apparently cured, 33.8% improved.

## MISSOURI.

18. MOUNT VERNON.—Missouri State Sanatorium (Dr. John Stewart; Medical Director, Dr. Wm. Porter). Opened August 1, 1907. Report ends with January 1, 1909. Elevation, 1,400 feet; 200 acres for gardening. The officials planned stone buildings with additions as appropriations were made by the State. It is intended to have eight one-story buildings, each for 24 patients, half men, half women; four buildings for the administration, medical purposes, help. At present there are two buildings, which accommodate 50 patients. Histories of each of the 135 cases treated, which show that all but 9 were improved.

## ILLINOIS.

19. NAPERVILLE.—The Edward Sanatorium (Dr. Theo. B. Sachs). Second annual report, for 1908. Under the direction of the Chicago Tuberculosis Institute. Can accommodate 35 patients at reasonable rates. Plans to enlarge to 100 beds. There are being built now a building for medical purposes, a laboratory, and a hospital for ten patients. Of 98 patients discharged during the year 55 were in first stage, and of these 20 were apparently cured, in 22 disease arrested; of 31 in second stage, 10 were apparently cured, in 18 disease arrested. In 1907, 12 patients; in 1908, 22 were treated with Deny's tuberculin.



## IOWA.

20. OAKDALE.—State Sanatorium for the Treatment of Tuberculosis (Dr. H. E. Kirschner). Opened February 1, 1908. Report up to June 30, 1908. Two hundred and eighty acres farming land. Capacity, 80; to be enlarged. Main building, with two pavilions, with two wings each. Each pavilion has a balcony and ten rooms, each for two patients. There were received 105 patients; discharged, 60; in 1 disease arrested, in 41 improvement. Tuberculin treatment.

## MICHIGAN.

21. HOWELL. Michigan State Sanatorium (Dr. R. L. Kennedy). Opened September 1, 1907. Report up to June 30, 1908. Elevation, 1,100 feet; 272 acres farming land. Present capacity, 48; to be enlarged to accommodate 100. Main building with dining room for 125, and annex with 8 beds for very sick patients; three shacks, one for eight and two for ten patients each. Medical report up to December 1, 1908, shows 104 patients admitted, 68 discharged; 13 of these apparently cured, in 14 disease arrested.

## MINNESOTA.

22. WALKER.—State Sanatorium for Consumptives (Dr. W. J. Marcle). Opened December, 1907. Report ends with July 31, 1908. Near a lake; 740 acres. At present two halls and two cottages for 60 patients. Although intended for patients in early stages, many advanced cases were admitted. Of 56 patients discharged, 2 of those in the first stage were apparently cured, 11 improved; 16 of those in the second stage and 15 of the more advanced cases, improved.

23. PINE CITY.—Pokegama Sanatorium for Incipient Cases of Pulmonary Tuberculosis (Dr. C. B. Tiesberg). Report for 1908-09; fourth annual. On a peninsula on South Lake and Lake Pokegama; for pay patients. The first two years only during the summer. Present capacity, 88; several shacks. The results in winter better than those during the summer. Of 67 patients, 15 were in first stage, 1 of these apparently cured, in 5 disease arrested, and 8 improved; of 17 in second stage, 2 were apparently cured, in 2 disease arrested, and 8 improved. Tuberculin used in most of the cases.



## NEW MEXICO.

24. FORT BAYARD.—U. S. Army General Hospital. For officers and soldiers of the regular army. Report for the year 1908. Elevation, 6,165 feet; capacity, 400. An administration building; eight rooms, for 15 officers, are being completed. Of 618 patients treated in 1908, 85 were in the first stage, and of these 16% were apparently cured, in 27% disease arrested; 338 in second stage, 5% apparently cured, in 18% disease arrested. Three hundred and thirteen stayed six months or longer. 68 in first stage, with 19% apparently cured, in 29% disease arrested; 170 in second stage, with 6.5% apparently cured, in 28% disease arrested.

25. FORT STANTON.—Sanatorium for Consumptive Seamen (Dr. H. S. Mathewson). Report June 30, 1907-08. Free, exclusively for tuberculous sailors, supported by the U. S. Government. Reservation of 43 square miles, on which the cattle and horses for the institution are raised. Elevation, 6,230 feet. More than 20 stone buildings; 90 tents, which the patients all prefer. Capacity, 250; admitted, 183; discharged, 175; 1 cured, 13 apparently cured, in 39 disease arrested, 23 improved. For three months 30 patients were treated with deep injections of Hg., but the method was abandoned because no good results were seen. Tuberculin given internally; results more encouraging. Thanks are due the Surgeon General and Commanders of the forts for these two reports.

26. SILVER CITY.—St. Joseph Sanatorium (Dr. Oliver T. Hyda). Founded 1901 by a religious order; 35 patients; report without dates. Elevation, 6,000 feet; main building, with court, one story, one room deep; each room has two balconies, one used for sleeping. A building for patients in advanced stage. Of those in first stage, 71% apparently cured, in 29% disease arrested; of those in second stage, 23% apparently cured, in 42% disease arrested.

## COLORADO.

27. COLORADO SPRINGS.—Union Printers' Home (Dr. W. L. Christopher). Report May 31, 1908-09. Founded 1898. Free for five-year members of the International Printers' Union; not exclusively for tuberculosis. Tuberculous patients in any stage to the number of 80. Large main building with

one wing, hospital. Medical report shows that 17 tuberculous patients, after a stay of from 29 days to 2 years and 5 months, were discharged able to resume work.

28. DENVER.—National Jewish Hospital for Consumptives (Dr. Moses Collins). Ninth annual report, April 30, 1908-09. Free for 135 poor patients; non-sectarian. Elevation, 5,200 feet. Main building, with offices, library; two wards with 12 beds each; operating room, chemical and bacteriologic laboratory; a pavilion for 35 patients, and one for women with 16 sleeping rooms. Very complete medical report, with many charts. Of 223 patients discharged, 113 were in early stage, and of these 24 were apparently cured, in 40 disease arrested. Average stay, 177 days. Charts for each case in which the conjunctival, cutaneous and subcutaneous methods for diagnosis were used. Data as to the results with bacillary emulsion, vaccine and mercury. Of 23 cases treated with mercury, in 1 disease arrested, 2 improved.

29. EDGEWATER (near Denver).—Evangelical Lutheran Sanatorium (Dr. Wm. N. Beggs). Founded 1905. Report April 30, 1908-09. Capacity, 33; moderate prices; patients in all stages. Main building of wood, with offices, dining room and rooms for officials; a group of small tents and a large tent in which the patients congregate for pastime. Of 102 patients, 58 were improved. Tuberculin and mercury were used in selected cases.

30. SANATORIUM of the Jewish Consumptives' Relief Society (Dr. J. B. Fish). Fifth annual report, for 1908. Free for poor patients in all stages. Capacity, 80. There are in the various States 20 associations which contribute toward the support of the institution. Four buildings, 32 tents; farming. Of 147 patients, 28 in the first stage 71 in second, were discharged, in 7 disease arrested, 91 improved.

#### CALIFORNIA.

31. LOS ANGELES.—Barlow Sanatorium (Dr. R. J. Cunningham). Sixth annual report, September 1, 1908-09. For poor patients who have been in the country one year. In a large park. Capacity, 33. Administration building, sleeping quarters and 9 cottages, accommodating 18 patients; Laboratory. Of 66 patients, 14 in the third stage, 2 were appar-

ently cured, in 6 disease arrested, and 28 improved. Several patients treated with tuberculin.

32. MONROVIA.—Pottenger's Sanatorium for Diseases of the Lungs and Throat (Drs. Pottenger and Browning). Report for the years 1906-08, inclusive. The leading sanatorium in the West; elevation 1,000 feet, in the spurs of the Sierra Madre; park of 40 acres. Capacity, 100 pay patients. Large administration building, with parlor, dining room, 20 rooms for patients. In addition, 62 bungalows, with or without bath, well-equipped laboratory, separate rooms for laryngeal cases. In the three years 447 patients were discharged, of whom 152 stayed less than three months, and are not included in the medical report. Of the others, 26 were in the first stage, of whom 23 were apparently cured, and in 3 disease arrested; of 35 in second stage, 20 were apparently cured, in 9 disease arrested; of 234 in third stage, 21 were apparently cured, in 56 disease arrested. A table shows the condition of 206 patients treated in 1906 and 1907, at the time of their discharge and at present. When discharged 46 were apparently cured, in 49 disease arrested, 80 improved; of those apparently cured, 42 are now apparently well; of the 49 reported as disease arrested, 12 are apparently cured, in 33 disease has been arrested; of the 80 improved, 4 are apparently well, in 13 disease arrested.

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\*Note to No. 14.—This sanatorium is the oldest of those now in existence, but not the first established. The compiler of this report on July 1, 1875, established a small sanatorium in the little village of Asheville, North Carolina, in the mountains. The sanatorium was conducted for six years according to Brehmer's principles. Inability to erect a larger and better building and the inconveniences of travel at that time caused the founder to give up the sanatorium. The report of the first two years appeared in Baltimore in 1877 and showed the following results: Of 12 patients in the first stage 11 were apparently cured or the disease arrested; of 14 in second stage, 3 were apparently cured, or the disease arrested.

## LXV.

### A CASE OF BRAIN ABSCESS WITH RARE OCULAR SYMPTOMS.

By C. BARCK, M. D.,

St. Louis.

The patient, Mrs. V. C., was seen by me for the first time on the 10th of January, 1910. She had been married for two years, but had no children. One brother and two sisters are living and healthy.

Previous history: Patient had a congenital, slight facial paresis on the right side. It had been noticed by her parents, soon after she was born. Since childhood she was suffering from a chronic otorrhea of the left ear. This was attended to at times, but in the main neglected. There was no pain in the ear, until the beginning of 1909. The pain increased by and by, and became very severe in March and April of the same year. The discharge was copious and in May the mastoid region commenced to swell. On the 26th of May a mastoid operation was performed at her home in the country. But, after the first week, the severe pain reappeared. It was located at that time mainly in the back of the head and neck. On account of this persistent pain, a second operation was performed two weeks later. The physician who was present during the procedure stated that a kind of radical operation had been done and that the ossicles had been removed. But the pain in the head continued. It was felt partly in the forehead and partly in the occipital region. Soon after the second operation vomiting set in, and during a period of three to four weeks the patient vomited after every meal. Then it gradually subsided.

One week after the second operation, the patient noticed that her vision was impaired; but no examination was made at that time. She stated that the condition was a changeable one; that at times she could see quite well, then again everything would appear dim. Since September, 1909, a decided



diminution in the visual acuity took place, and six weeks prior to her consultation with me she noticed—and her family physician found on rough examination—that she had hemianopia. She was not able to see within the right half of the field of vision. Patient was still able to read on the 1st of November, 1909, but not since.

Examination: No discharge from ear. Large, dry cavity. Drum membrane and ossicles wanting; but the posterior wall in its entirety present, proving that no radical operation could have been performed. In the mastoid region a large, irregular scar, somewhat depressed. No fistula; no redness around the scar. No pain on moderate pressure. Generally speaking, it was the condition we find after the healing of a mastoid operation. But there was one spot, about one inch above and one inch behind the scar, which was very painful to pressure, as well as to percussion with the style (a method recommended by me some years ago). The painful area was an irregular circle, with a diameter of about two-thirds of an inch. On repeated examinations by different observers, this painful site was invariably discovered. It corresponded to about the hinder portion of the temporal, or to the foremost portion of the occipital lobe.

Spontaneous pain was not experienced within this area; but was located farther back in the occiput. There was no pronounced stiffness in the muscles of the neck, but movements of the head, especially forward or bending movements, were very painful. There was no dizziness and never had been. Examination of the labyrinthine functions proved them intact.

The vision of the right eye was  $1/60$ ; that of the left  $1/36$ ; could read none of Snellen's test types. There existed complete right homonymous hemianopia. The division line was vertical, passing through the point of fixation. There was no palsy or paresis of the external ocular muscles. The ophthalmoscope revealed a choked disk of considerable degree in both eyes. The difference between the height of the swelling and the surrounding retina was measured as 3 diopters, corresponding to an elevation of 1 mm. In the left eye there were two large hemorrhages close to the optic papilla, one of them having a diameter as large as that of the disk. No hemorrhage in the right eye.

The paresis of the right facial nerve, mentioned in the anamnesis, was of a moderate degree. It was confined to the lower branch of the nerve, controlling the muscles around the mouth, and became most apparent when the patient laughed. The upper branch, controlling the orbicularis muscle, was intact. Relatives made the statement that this paresis had become more manifest the last month (which statement was at the time accepted "*cum grano salis*").

Speech and memory were not affected. The patient spoke fluently, rather rapidly. She answered all questions in a precise manner. Her physician stated that in June her memory had been somewhat defective; that she could not remember names correctly; but the report was too vague to be of any value. The mental state of the patient, however, was an abnormal one. It was one of labile psychic equilibrium. As a rule she was very much depressed and wept frequently. Moreover, she was very excitable, so that the examination had to be interrupted at times.

During the next few days of observation the pulse rate varied between 80 and 100, whilst the temperature was always found to be normal.

I made the diagnosis of an otitic brain abscess in the left temporal lobe, reaching far back, so as to encroach upon the optic radiation (Gratiolet's visual fibres) in the posterior part of the capsula interna. The symptoms seemed to me sufficiently clear to assume the presence of a cerebral abscess, and the only question to my mind was that of the differential diagnosis between the location in the temporal lobe or in the cerebellum. Hemianopia could be the consequence of a lesion in either; in the first instance by affecting the optic radiation or the optic tract; in the second by injuring the cortical center in the occipital lobe, either by transmitted pressure or by direct destruction after perforation of the tentorium. Such a case is on record. The fact that the dividing line between the preserved and the destroyed halves of the fields of vision passed through the point of fixation, may have been accepted in favor of the former view. For, according to some authorities, the dividing line, in lesions of the optic tract, is a vertical one, and the central vision, in consequence, materially impaired. In lesions beyond the primary centers (geniculate bodies) the dividing line passes in a curve around the center

of the field, so that the macular region is spared and the central vision very good, often normal. This theory, however, is not yet generally accepted; and, furthermore, the presence of the enormous choked disks complicated and obscured the clinical picture to such an extent, that I did not feel justified to draw any conclusions from these findings of the perimeter.

My diagnosis of a localization in the temporal lobe rested mainly on the following points: The circumscribed area, which was so decidedly painful to percussion; the want of cerebellar symptoms, as ataxia, dizziness, etc., and the absence of suppuration of the labyrinth. At first, on noticing the facial paresis of the right side, I thought that this symptom might also be used for topic diagnosis, speaking again in favor of localization in the temporal lobe, but after learning that it was congenital, it had to be left out of consideration.

During the following days a number of consultations were held with an oculist, Dr. J., and a neurologist, Dr. G. The opinion of the former coincided with my view, but the latter, whilst not denying the possibility of a suppurative process, maintained the probability of a chronic encephalitis, basing his opinion mainly on the congenital paresis of the facial nerve. Yet, under the existing circumstances, he considered an operation justified.

Operation: Performed on the 14th of January. The section was made through the old scar and continued upward and backward. In the exposed mastoid there were still some small carious foci; but the bone was generally firm. The posterior wall, towards the cerebellum, consisted of perfectly healthy, dense bone. The supramastoid crest, the tegmen antri and the posteroinferior portion of the squama of the temporal bone were then removed, to expose the middle cranial fossa. The bone of these regions was enormously sclerosed and hard like ivory, requiring tedious work with the bone forceps. An area of the dura, about one inch in diameter, was laid bare. The upper and hinder portion of this exposed area showed a spot of marked discoloration, which corresponded quite closely to the painful site found on percussion. After incision of the dura, the brain substance bulged out under considerable pressure. At the spot mentioned, the dura was adherent to the cerebrum. The tem-



poral lobe was then explored, partly with a long narrow knife and partly with a trocar. I introduced the instrument about twelve times in different directions, going in as far as 6 cm. Special care was taken to go backward and upward as far as permissible, and I came in contact with the tentorium several times. But no pus was encountered. A drainage tube, 5 cm. long and 1 cm. in diameter, was inserted, and the usual dressings applied.

The subsequent course, for the first four weeks after the operation, was a very favorable one. The immediate effect of the release of the intracranial pressure was remarkable. The pain in the head disappeared completely and the entire mentality of the patient became changed. The psychic depression had given way to a happy, at times even hilarious, disposition. She was convinced that she would recover. There was no rise of temperature; sleep and appetite were excellent. The fundi were examined every few days; three days after the surgical interference a considerable decrease in the size of the choked disks was noticed and they gradually became smaller during the following weeks. Within this period the vision of the left eye improved to a certain extent, so that the patient could read Snellen XII and later on XI with difficulty. The sight of the right eye did not improve materially. The hemianopia remained always the same.

On the second dressing it seemed that there was some pus in the tube; but none could be discovered subsequently. As was to be expected, a cerebral prolapse of medium size formed. This had to be clipped on two different dates, on the 24th of January and on the 9th of February.

The patient had been out of bed for some time, when a gradual change in the clinical picture took place. On the 7th of February the temperature rose to 100 and kept on rising during the following days, reaching 103-104. The headaches reappeared, becoming so severe as to necessitate the administration of anodynes. On the morning of the 14th there was loss of speech (amnesic aphasia). Then coma set in, which increased rapidly until the exitus letalis on the 18th of February.

Postmortem: The brain was removed and upon the advice of Dr. G. put into formol solution, to be cut into sections afterwards. There was a moderate degree of leptomeningitis,



more pronounced over the left side. Furthermore, there was a fresh hemorrhage in and around the Sylvian fissure. Whether or not an abscess of the brain was present, could not be determined at the time of removal. When the specimen was sectioned, ten days later, by Dr. G., Dr. Th., pathologist, and myself, a cerebral abscess was found. It was relatively small, about three by four cm. in diameter, and surrounded by a thin capsule, which was partly broken. The pus was almost odorless. Whether this was due to the formol or whether it had been inoffensive primarily, I am unable to state. The abscess cavity was located in the extreme posterosuperior portion of the temporal lobe. After placing the sections of the brain together, we measured the distance of the abscess from the point of incision, and found it to be  $6\frac{1}{2}$  cm. I am, of course, aware of the fact, that after these manipulations with the specimen, the findings are only approximately correct; yet we were very careful to restore the normal condition as far as possible.

Remarks: The clinical picture was somewhat obscured by the fact that the crossed facial paresis was a congenital one. Had it been acquired it would have been a valuable symptom, proving a lesion of the capsula interna. It furthermore weakened to a certain degree the conclusions which could be drawn from the hemianopia. The subsequent improvement of the paresis placed the mentioned statement of the relatives in a different light; and the inference from this improvement in view of the autopsy is, that the previously existing paresis was increased by the pressure of the brain abscess and improved after this was relieved. But apart from the facial paresis, the hemianopic symptoms were so definite, that I assumed, on this basis, an encroachment on the visual radiation in the capsula interna. In spite of the vertical dividing line of the field of vision, I did not consider an affection of the optic tract probable. I furthermore concluded that the abscess must be a very large one, in order to reach so far back. Moreover, this conclusion seemed to be corroborated by the enormous degree of the choked disks, such as I have never seen before in brain abscess.

There are about twelve cases on record in literature, where otitic abscesses of the temporal lobe caused hemianopia. But in none of them is it stated, whether the dividing line of the

field of vision passed through the very center, or whether the macula was spared.

The retrogression of the choked disks after the release of the intracranial pressure was a very rapid one; and if conclusions may be drawn from a single experience, this would speak in favor of the "pressure theory," against the "toxin theory" of choked disk. Since the one factor, the tension, was removed by the operation, whilst the other, the abscess, remained undisturbed, the lesson learned from the case is equivalent to that of a physiologic experiment.

Otitic cerebral abscesses are, as a rule, found close to the primary focus in the bone. In this case the distance was unusually far, and even the path of infection could not be detected at autopsy. There is but a single case on record of an abscess at the distance of 7 cm. from the surface, which was found and opened surgically; the termination was fatal, because of the impossibility to establish proper drainage. For this very reason, I believe, that also in my case the outcome would have been the same had the abscess been opened. The advice given by Koerner and others is: not to enter with instruments farther than 4 cm., in order not to injure the lateral ventricle. As previously stated, I introduced the knife considerably farther. During the after-treatment I felt inclined to probe once more, but as I had about abandoned the diagnosis of a suppurative process, I considered it contraindicated. The aphasia, which occurred shortly before death, is, of course, explained by the recent hemorrhage in the region of the Sylvian fissure, affecting the center of speech.

## ABSTRACTS FROM CURRENT OTOLOGIC, RHINOLOGIC AND LARYNGOLOGIC LITERATURE.

### I.—EAR.

#### Report of One Hundred Radical Mastoid Operations.

WELTY (*Cal. State Journal*). There were eighteen cerebral complications in this series, of which two died. Both in extremis before the operation. He has had, therefore, no proper operative mortality at all, a most satisfactory report. There were seven preoperative cases of facial paralysis, all of which recovered except the fatal case. In one very interesting case, all individual cells in the mastoid were filled with cholesteatomatous masses. Fifty per cent of the cases were cholesteatomatous. Welty promises all patients with a hearing distance for whispers of 1-6 feet before the operation a certain improvement in the hearing distance as a result of the operation. Fifty-seven cases were improved in hearing, twenty-six remained the same, six were made worse, three cases lost to observation, five still under treatment. His favorable results he attributes to his method of skin grafting, the details of which will be shortly published. Forty-seven cases were completely dermatized under eight weeks. His recent cases show marked improvement over this time.

Horn.

#### The Determination of the Upper Tone Limit.

HEGENER, Heidelberg (*Monatschrift fuer Ohrenheilkunde*, Bd. 44, 1910, pp. 749). In a paper read before the last German Otological Congress, Hegener has repeated his experimental work of two years ago, and comes again to the conclusion that the upper tone limit of hearing in human beings is in the neighborhood of 20,000 double vibrations. This is only in the case of individuals who are specially trained to hear high sounds, the ordinary individual can appreciate but 17,000. The findings of the earlier investigators, whose results varied from 27,000 to 66,000, are carefully reviewed. Their methods were again tried, and in the light of modern physical research, especially by a method which Hegener has himself invented, of determining vibrations by

means of the gas flame, there seems to be no doubt that the results of the earlier investigators were too high, and were the result of faulty technical means of experimentation. In this he has the support of Prof. Karl Schaeffer, of Berlin, and Prof. Shultze, of Marburg, so there can be no question of the accuracy of his results.

His statement of two years ago, that the Galton whistle, as constructed by Edelmann, was to be cast aside as a method of examination, caused then a profound sensation, and, in spite of the efforts of that great Munich physicist, his newly constructed whistle, with the valve for controlling the air pressure, has proved by these last experiments of Hegener, to be almost as faulty as before. He repeats, that the monochord of Schultze is the only instrument that can be depended upon for the determination of the upper tone limit. As is well known, this instrument is nothing more than a piece of steel wire stretched between two posts about 50 cm. apart at a certain tension. A clamp enables us to divide the wire into any length, and a scale on the side makes it possible to read off the number of vibrations and the note. It was originally manufactured only by Görs, who is Prof. Schultze's mechanician in Marburg, but can now be obtained from Pfau in Berlin and at the Edelmann institute in Munich.

Horn.

#### **Cholesteatoma and Its Relation to Otogenic Meningitis.**

DANELON, Triest (*Monatschrift fuer Ohrenheilkunde*, Vol. 44, 1910, p. 760). During the years 1908 and 1909 there were received in Prof. Urbantschitsch's clinic, in Vienna, 36 cases of meningitis, 14 cases followed an acute otitis, 22 followed chronic suppuration. The 22 cases of meningitis following the chronic process were divided as follows:

(a) Ten cases occurred without the presence of cholesteatoma: 2 cases of tuberculous meningitis; 1 case purulent meningitis of the base with pachymeningitis interna; 2 cases of sinus thrombosis with intensive extradural abscess; 2 cases of purulent labyrinthitis; 2 cases of abscess of the temporal lobe; 1 case of a large sequestrum.

(b) Twelve cases occurred complicated with cholesteatoma: 1 case of temporal lobe abscess with fistula of the horizontal canal; 3 cases of temporal lobe abscess; 1 case of



temporal lobe abscess with purulent labyrinthitis; 3 cerebellar abscesses; 3 cases of labyrinthitis; 2 cases of sinus thrombosis.

In conclusion, one must always take into consideration the cause of the meningitis, whether it follows an acute otitis, a chronic suppuration, or a chronic suppuration complicated with a cholesteatoma. In the acute process the meningitis takes place by direct contact. In the cases complicated by a cholesteatoma the infection follows secondarily on an intracranial complication. The ordinary suppurations occupy a middle place. The practical result of this paper is the fact, that given a case of suspected meningitis, where by the operation we find a cholesteatoma, we must not abandon the operation until we are absolutely satisfied that no intracranial complication exists. This means a systematic inspection of the sinus and the dura of both the anterior and posterior cranial fossae.

*Horn.*

## II.—NOSE.

### **A Comparison of the Oral and Nasal Methods of Operating on the Nasal Septum.**

HALLE, Berlin (*Monatschrift fuer Ohrenheilkunde*, Vol. 44, 1910, p. 826). In these ANNALS for June, 1909, the reviewer sharply criticised Kretschmann's method of operating for a deviated septum through the mouth. Since that time he has seen nothing in the American literature on the subject, so concludes that it has not yet been tried in America. That it was received with some degree of consideration in Germany is evident from the present long article of Halle, who considers it necessary to compare the two methods. It is certainly remarkable how many indications have been found for it. Loewe finds the operation called for:—

1. In babies and children in the first year of life.
2. In the so-called vertical fracture of the septum, as soon as a misplacement of the anterior fragment has taken place.
3. In correcting crooked bridges, where the cause is due to a broken septum.
4. Where, on account of processes such as thickening of the floor of the nose, spines, and deformities of the crista incisiva, etc., one has not room to work.
5. Specialists who have had little opportunity to carry out the submucous operation in difficult cases.

Supposedly following these indications he has operated 53 cases, but I am unable to find out how many were under one year of age.

Halle made a careful study of the operation on the cadaver and comes to the conclusion that practically every indication which Loewe gives is more than overbalanced by the overwhelming disadvantages of the method. The general narcosis, the long wound, the severe hemorrhage, and the long after-treatment are disadvantages which the possible greater field of vision scarcely compensates for. *Horn.*

#### Two Cases of Fatal Meningitis Following the Killian Operation.

JACQUES (*French Oto-Laryngological Society Proceedings*, 1910). Two apparently favorable cases for operation died forty-eight hours after the procedure of fulminant meningitis. The autopsies showed no dehiscence of the bony walls. He considers that the operation should only be carried out in the interval between attacks of pain, and that the region around the upper turbinate, the cribriform plate and the upper part of the septum must be carefully avoided.

*Horn.*

#### The Nasal Reflex Neuroses.

GUSTAV KILLIAN (*Deutsche medicinische Wochenschrift*, No. 40, 1910). The nasal reflex neuroses originate as the result of an excessive sensitiveness of the nasal mucous membrane, particularly with such forms of irritation causing tickling. Even the slightest local, regionary or remote reflexes may bring this about, and for this reason reflex neuroses may easily develop.

For the clinical demonstration of the subject, it is important to divide the neuroses into three classes, ethmoidal, sphenoidal and olfactory. A therapy based on such a division may be very effective, and this is particularly true of the local therapy. Leaving out of account the removal of nasal stenoses and chronic inflammatory processes of various kinds, the most rational treatment is, first of all, to investigate parts of the nose that are hyperesthetic, because the reflexes start in such regions. It is also of great importance to determine what variety of nasal reflex neurosis exists, and it is not uncommon to have mixed forms.

Testing the hyperesthesia of the nasal mucous membrane will show us whether our treatment will have to be applied anteriorly or posteriorly, or to both regions. For a temporary quieting of the nerve endings we may use cocain, and for superficial destruction, caustic agents, such as trichloroacetic acid and chromic acid. For deeper cauterization, electrolysis and the cautery may be used. Better results will follow extirpations of the hyperesthetic areas of mucous membrane, which are common, particularly when chronic hypertrophies of the inferior turbinate must be removed at the same time.

In ethmoidal neuroses, the writer has taken special care to remove irritable zones in the anterior end of the inferior turbinate. In sphenoidal neuroses, the hyperesthetic region in the middle and posterior end (high up) of the inferior turbinate should be removed.

For the temporary cure of ethmoidal neuroses, the writer several years ago, recommended cauterizing the "four points" with trichloroacetic acid.

In old and stubborn cases of ethmoidal neuroses, the unilateral and bilateral resection of the ethmoid nerve, by way of the orbital cavity, has been recently and successfully first performed by Eugen Jonge. Neumeier and Bloss followed him, and the author has also had a successful case.

The author has recently, instead of performing this operation under general anesthesia, been doing an intranasal resection with cocain and adrenalin. The septal branch is easily reached, and the lateral branches, slightly above the anterior end of the inferior turbinate, are also accessible. The septal branch of the sphenopalatine nerve can be reached above the upper edge of the choana. The branches that extend to the inferior turbinate posteriorly can be reached with a properly curved knife. Olfactory neuroses cannot be treated in this way. Caustics are contraindicated, but milder agents, having a slighter destructive action, may be of use. *Theisen.*

**On the Significance of the Nasal Sinuses in the Production of  
Bronchial Asthma.**

W. N. NIKITIN (*Archiv. fuer Laryngol. und Rhinol.*, Bd. 23, Heft 1) describes his treatment, which consists of hot water and steam baths for the purpose of furthering per-



spiration, together with the administration of internal remedies with the same object. Locally he has the nose washed daily with sea salt, in the proportion of a teaspoonful to a litre of water at body temperature. The irrigation is carried out morning and evening, and the litre of water must be used on each occasion. This is best done by a jug with a rubber tube and stop cock, and the nasal olive. The stream of water must also be directed into the pharynx of the patient, while he holds his head forward and says E. The sea salt owes some of its activity to the content of iodine. This treatment, independently of other remedies, is beneficial for the nasal chambers, and leads in the author's opinion at times to the cure of asthma.

Goodale.

**Bilateral Incision of the Mucous Membrane in the Submucous Resection of the Nasal Septum.**

S. SREBRNY (*Archiv. fuer Laryngol. und Rhinol.*, Bd. 23, Heft 1) recommends an incision on each side of the nasal septum in this operation, and finds that perforations are not more frequent, while the time of the operation is decidedly shortened. He operates now in fifteen to forty minutes, according to the difficulty of the case. A bent incision from above down is made and prolonged on the nasal floor, it giving, in this manner, a larger space, and rendering less likely the tearing of the mucous membrane, after the introduction of the Killian speculum. After separation of the mucous membrane from both sides, the cartilage is cut through, the Killian speculum introduced, and as much of the cartilage and bone excised as necessary. After the operation the nose is tamponed on each side with especial care as to the disposition of the tampons, these being removed after three days.

Goodale.

**The Lymph Vessels of the Accessory Sinuses of the Nose.**

L. GRUENWALD (*Archiv. fuer Laryngol. und Rhinol.*, Bd. 23, Heft 1) injected the head of a man, who had been killed immediately before by an accident, and examined the lymph vessels of the nose, with the following result:

On the posterior end of the hiatus semilunaris, the middle point of the injection is shown by a thick, slightly branching mass of color. From this point numerous branchlets stretch,



uniting with each other through fine lateral arms, as follows: Over the whole posterior recess of the middle meatus, together with the lower part of the lateral aspect of the middle turbinate covering it; the whole upper surface, both posteriorly and anteriorly, and also a certain portion of the median aspect of the lower turbinate; the upper and median aspect of the middle turbinate, corresponding to the injection phenomena on the lateral aspect. The margins of the bulla ethmoidalis, the processus uncinatus, and the agger nasi, together with the deeper lying lateral walls; the ethmoid sinuses when opened on removal of the median walls; a small communication which occurs in this specimen between a cavity in the bulla and the interior of the nose, is recognized by the penetration of the lymph vessels; from the hiatus semilunaris a small branch rises to the posterior wall of the frontal mucous membrane in the sphenoethmoidal recess. In the level of the choanae the branches unite concentrically towards the lower margin. After removal of the bulbus, together with the margins of the orbit from the median orbital wall, there is seen a blue injection in the upper third of the hiatus semilunaris. There is no injection in the periorbita itself.

Goodale.

#### Lymphangiectatic Myxoma of the Nose.

HAJEK AND POLYAK (*Archiv. fuer Laryngol. und Rhinol.*, Bd. 23, Heft 1) report a case of tumor of this type, arising from the base of the skull in the neighborhood of the lower margin of the sphenoid, infiltrating the body of the sphenoid, and the roof of the ethmoid, and extending later over the whole septum, the hard palate and the roof of the mouth, without metastasis, and terminating fatally by complicating tuberculosis. The authors have not been able to find a similar case in the last twenty years.

Goodale.

#### Experiences With Intranasal Exposure of the Maxillary Sinuses.

STURMANN (*Archiv. fuer Laryngol. und Rhinol.*, Bd. 23, Heft 1) reports a series of his cases, in which he has operated by his method with satisfactory result. He uses local anesthesia; in the majority of cases cocain and adrenalin. After painting the canine fossa and the lower meatus with cocain, he injects from the mouth, under the periosteum of the facial

wall and below that of the lateral wall, two centimeters of his solution, next one centimeter of the solution through the inner surface of the ala nasi. The infiltration on both walls must reach far back; also a 2 per cent cocain solution may be sprayed into the maxillary sinus. If general anesthesia is used, the injection of cocain and adrenalin must be employed in addition, to diminish the otherwise excessive bleeding.

The operation is performed in the following way: An incision is made anteriorly in the nasal entrance, not more than half a centimeter from the free margin of the ala, by incising the nasal aspect of this with a bistoury, and carrying the cut parallel to the outer aspect, as far as the bone, which one finds about a centimeter from the aperture externally. The incision is prolonged upward and downward sufficiently, and at both ends turns toward the median line, in order to remain parallel to the margin of the nasal opening. This position of the incision is done in order that sufficient room can be obtained for the opening in front of the inferior turbinate, and also in order that a freer view may be obtained of the interior of the sinus. Laterally the cheek may be undermined as far as wished, but towards the median line the periosteum causes a little difficulty by its firm adhesion to the margin of the aperture. With the bent, blunt end of the author's elevator, it is possible to pass around the corner, and to lay free the bony nasal wall. This separation extends not only to the lower meatus, but also to the point of attachment of the lower turbinate of the maxillary bone, and of the mucous membrane covering this in front of the middle meatus. The author introduces a Fraenkel's nasal speculum, with blades five centimeters long, in such a way that the median blade lies between the maxillary bone and the mucous membrane of the lateral wall, including the anterior half of the lower turbinate, while the lateral blade lies between the maxillary bone and the cheek. Between the blades is the exposed pyriform aperture. The speculum remains in this position, so that no further retractors are required. As large a trephine as possible is placed directly upon the margin, and carried horizontally backward and outward. Since it runs between the two blades of the speculum it is not possible to wound the neighboring parts. Sometimes it happens that the trephine does not drill sufficiently in an outward direction,

and removes thus only a portion of the bony plate without opening the sinus. If this does not happen, one immediately enters the sinus. The opening is now enlarged, either with a trephine or bone forceps. It is necessary to take away as much from above as to afford a view of the roof of the cavity. This may be done without fear of deformity. On the nasal floor the bone is thickest, and its removal the most difficult. Nevertheless, it is of great importance that not the slightest wall divides the two cavities on the floor. The author removes as much of the facial wall as to permit a free view of its inner aspect. The extent of this depends on the difference in level between the anterior convex half, corresponding to the canine fossa and the posterior concave half. One must also remove as much of the convex nasal wall as to give a view of the angle between it and the posterior wall. The two walls are readily removed with the author's bone forceps. This permits now an inspection of the mucous membrane of the cavity, which is now irrigated and freed from any polypi present. Mucous membrane which is only thickened or edematous does not need to be curetted. Furthermore, it is perfectly possible in the subsequent treatment to remove any portions of the mucous membrane that may be necessary. The anterior half of the maxillary sinus is now seen to be separated from the nose by a partition which consists anteriorly of the skin of the nasal entrance, posteriorly of the mucous membrane of the lower and middle meatus, and carries unwounded the lower turbinate. This is now cut through from the upper end of the original incision in a horizontal direction, and then vertically in front of the lower turbinate as far as the nasal floor. In this way one obtains a flap with the base on the floor of the nose. Since it is anteriorly thick and usually too large, it must be thinned and cut correctly, in order not to form a disturbing growth on the nasal floor. The cavity is now filled with iodoform gauze, while the flap is fixed on the floor. The subsequent treatment consists in the reduction of swelling and relief of pain. The tampons are usually discontinued at the end of fourteen days.

*Goodale.*



## III.—PHARYNX.

## Local Anesthesia of the Tonsils.

M. RUPRECHT (*Archiv. fuer Laryngol. und Rhinol.*, Bd. 23, Heft 1) recommends local anesthesia of the tonsils by injection of cocain, and finds the amount of bleeding small, while the tendency of the patient to gag can be readily controlled with a certain care in the use of the tongue depressor. Even in the case of children this may be done, and is especially to be recommended for those with a lymphatic constitution and enlarged thymus.

Goodale.

## Functions of the Tonsils.

O. LEVENSTEIN (*Archiv. fuer Laryngol. und Rhinol.*, Bd. 23, Heft 1) reviews at length the various theories concerning the physiology of the tonsils, and considers that none of them can withstand criticism. No proof has been adduced that the tonsils fulfill a peculiar or important function of the organism. It must be regarded as undecided whether the tonsils represent an instance of atavism, and were originally useful to our remote ancestors. The physiologic disappearance of the adenoid in adult life, and the frequent atrophy of the faucial tonsils at an early age, must give us cause for thought in this connection, especially when we remember that man possesses also another adenoidlike organ, namely, the thymus, which atrophies in early life, and is correctly regarded as an atavistic organ. The author maintains that we have no proof for the existence of a function of the tonsils, but even then he adopts a conservative standpoint, and would regard our task as chiefly to consist in the removal of the possibilities of infection by rendering this organ more resistant through general or local measures. The laryngologist would not readily permit his tonsils to be excised, even if they did not appear as well armed against infection as they should be, since the process is by no means a simple one, and, furthermore, it must be remembered that adenoid tissue always undergoes regeneration, so that permanent absence of the lymphoid tissue cannot be anticipated.

Goodale.

## Tonsillectomy.

BLEGVAD (Proceedings of the Danish Oto-Laryngological Society, Feb. 16, 1910). It is extremely interesting to Ameri-



cans to note the gradual awakening of the European laryngologists to the necessity of the radical tonsil enucleation. This author reports sixteen cases before the Society in which he has had no serious after bleeding. The operation was evidently carried out with a snare without any attempt to dissect free the capsule. His indications for the operation are: 1. Repeated attacks of acute tonsillitis. 2. Repeated attacks of peritonsillar abscess. 3. In cases of tonsillitis lacunaris which give rise to well marked symptoms. 4. In those cases where the patient has suffered from some general disease directly attributed to the tonsillar infection. 5. In cases of adenitis colli where no other source of infection can be found. In the discussion, Schmiegelow remarked that he had carried out many thousand tonsillotomies with the Mackenzie tonsillotome, and was very well satisfied with his results. The partial resection (with the tonsil punch) he found particularly valuable in the case of small sunken diseased tonsils, and considers the radical operation as recommended by Blegvad as unnecessary and too complicated.

Mygind, who was this year a guest of the laryngological section of the A. M. A., added that he considered the complete tonsillectomy, in "small but diseased tonsils" (the remark in quotations was taken from the original report) has been a large and fruitful field.

Jörgen Möller considers the peritonsillar abscess as arising from the upper pole of the tonsil "where there is no fibrous capsule to be found".

Blegvad, in conclusion, said that the operation did not allow all the adenoid tissue that lay between the pillars to be removed, but that the upper pole could be completely removed.

*Horn.*

#### IV.—LARYNX.

##### Laryngocele.

JACOB GUGENHEIM (*Archiv. fuer Laryngol. und Rhinol.*, Bd. 23, Heft 1) reports a case in which a laryngeal sac was produced by long continued expiration in the playing of wind instruments. The disturbances were slight or transient. The condition represents an anatomic curiosity, and illustrates the genetic relation between man and ape. In the majority of apes the air sac represents a useless, obsolete appendix of the

vocal apparatus, the physiologic relation of which is in doubt, and we may therefore regard it here as representing an instance of reversion to the original type. We cannot consider that the air sac of man has been inherited from the apes, the probability being rather than both derive the organ from a common ancestor, antedating ape and man.

Goodale.

#### Amputation of the Tubercular Epiglottitis.

SEIFERT (*Zeit. fuer Laryn., Rhin. und Grenzgebiete*, Bd. 3, Heft 2, 1910) reports cases up to date and adds five cases of his own. He used the Alexander guillotine, and his results were invariably good. Complete healing of the cut surface followed in ten to fourteen days, the dysphagia was always relieved, and the lung conditions always improved or cured.

Horn.

#### V.—MISCELLANEOUS.

##### Acute Thyroiditis.

W. LUBLINSKI (*Wiener medicinische Wochenschrift*, Oct. 15, 1910) criticises a statement made by Goldberger, in his article in No. 32 of this weekly, that no case of true iodid thyroiditis has been reported.

Lublinski, several years ago (*Deutsche med. Wochenschrift*, No. 8, 1906), published a case. A woman, aged 52 years, with syphilitic ulceration of the tonsils, was given, after the mercurial treatment, a 5 per cent solution of iodid of potash. After taking this for four days she had an acute thyroiditis. Her thyroid, before beginning the treatment, had been perfectly normal. After stopping the iodid the swelling of the thyroid disappeared within a week. In order to prove that the iodid had caused this, the author put the patient on the same treatment again, and the same thing happened.

Marothe, Sellei and Gondurov have reported similar cases.

Cases of acute thyroiditis are not as rare as Goldberger believes.

The author has reported cases following acute angina. Kocher has classified such cases as metastatic.

It is well known, however, that an inflammation of the thyroid gland occurs with different diseases, such as septic fever, typhoid and pneumonia. In most of these cases supuration occurred, and in the pus the pathogenic organisms of

the primary disease were found, either alone or mixed with pus cocci.

The author has reported four cases of acute thyroiditis in women, following acute angina. This usually occurred on the fifth or sixth day after acute symptoms of the sore throat subsided, and was accompanied by another rise in temperature.

The author believes that the complication of angina with acute thyroiditis is analogous to the rheumatic conditions complicating sore throat.

In this class of cases the development of abscesses in the thyroid has not been observed.

Theisen.

#### Concerning Leprosy.

GERBER (*Deutsche medicinische Wochenschrift*, No. 37, 1910), discussing the primary lesion, quotes Sticker, who believed that this was in the nasal mucous membrane. While this view has not been altogether accepted, there are many observers, particularly in the tropics, and, having a large amount of material at their command, who believe that Sticker's opinion is the correct one.

That leprosy of the face originates primarily in the nasal mucous membrane will appear rational to those who have studied the similar conditions in lupus. The view of Sticker and his supporters is not new, but was advanced 200 years ago by Wilhelm ten Rhyne, and even in the time of Aretaeus, leprosy was considered an inhalation disease.

The author at the present time has under observation in the Memeler leprosy home fifteen cases. These cases are being carefully studied by his first assistant, Dr. Cohn, and it was found that all of them show more or less severe evidences of the disease in the nose, pharynx and larynx.

In the author's work (*Beiträge zum Kenntniss der Lepra der oberen Luftwege und der Verbreitung der Leprabacillen, Archiv. f. Laryngol.*, Bd. 12, 1901), he gives the following figures: The nose is involved in 95.83 per cent of all cases, the pharynx in 73 per cent, and the larynx in 70.27 per cent.

His investigations would indicate that sooner or later almost all patients suffering with leprosy, develop lesions in the upper air passages, and furthermore, that a large percentage of patients with laryngeal leprosy die as a result of this complication.

The author comes to the following conclusions:

1. As a rule, bacilli are not found in the upper air passages, when healthy, of patients affected with leprosy.

2. This is also true of the upper air passages of healthy persons coming in contact with leprosy cases.

3. *Lepra* bacilli are present in large numbers in the diseased upper air passages of leprosy cases, and are most abundant in the nose.

4. Secretion lower down in the air passages is much freer of bacilli.

5. Bacilli can be found in fluid as well as dry secretion, after weeks and months, and as long as one year.

6. Bacilli are scattered around by sneezing, coughing and spitting.

7. Handkerchiefs are carriers of the bacilli, and many bacilli can be found in the water in which they are washed. All articles of apparel coming in contact with mucous secretion also carry the bacilli.

8. Gerber did not find bacilli in rooms of patients that were kept properly clean; neither in the beds nor on the floors or walls.

9. No bacilli were found in the tracheal secretion below tracheotomy wounds.

*Theisen.*

#### Concerning Foreign Bodies in the Esophagus.

PERNICE (*Deutsche medicinische Wochenschrift*, September 15, 1910). According to Kaloyeropulos, foreign bodies in the esophagus, in about 40 per cent of the cases, are tooth plates. The question of extraction, whether by esophagotomy or gastrotomy, when such foreign bodies are impacted in the lower part of the esophagus, is important, and has not been positively determined.

In regard to the diagnosis, the author states that the fact that a foreign body could or could not be swallowed should not be considered. Even large foreign bodies may remain in the esophagus for a long time. Eitel has reported a case in which a tooth plate remained impacted in the esophagus for six and one-half years, and Bull mentions a case in which a similar foreign body was in the esophagus for a year and a half.

In every case in which the presence of a swallowed plate



is suspected, either an examination with a probe should be made, or by esophagoscopy, and the examination should be made as soon as possible. Of forty cases of foreign body in the esophagus, collected by Naumann, seven terminated fatally, four of the fatal cases being the result of impacted tooth plates. It is particularly important that sharp or angular foreign bodies should be removed as soon as possible. A radiograph is of the greatest assistance in locating the foreign body.

The prognosis depends upon the nature of the foreign body, the length of time it has been in the esophagus, and its location.

Foreign bodies present in the esophagus for a long time may cause swelling, pressure, ulceration, enlargement of the glands, infections or erosions of the blood vessels. Para-esophageal abscesses and mediastinitis have been reported. Neuhaus has reported a case of fatal hemorrhage through erosion of the carotid.

Immediately after the swallowing of a foreign body, attempts at removal, with or without the aid of esophagoscopy, may be made. Should such attempts fail, esophagotomy should be performed as soon as possible. If the foreign body is situated deep down in the esophagus, so that it cannot be felt with the finger through the esophagotomy wound, the method of procedure must be changed. In such cases Dobbertin recommends the opening of the esophagus through the posterior mediastinum. In the case of a tooth plate, a gastrotomy may have to be performed and the foreign body removed in this way.

*Theisen.*

## BOOK REVIEW.

### **"Die Krankheiten der Nase und des Nasenrachens."**

By CARL ZARNIKO, Hamburg. Published by S. Karger, Berlin. Price, 19.60 marks.

The third edition of "Zarniko's Diseases of the Nose and Nasopharynx" is a book of over 700 pages. The other two editions were large and favorably received, and the present is but the logical outcome. It is the summation of 50 years of active practice in rhinologic work and will serve as an enduring monument to the intellectual activity of this great worker.

To select any given chapter as especially good would be slighting the rest of the book. One has a feeling that the conclusions are based on an unbiased study of the literature of the entire world and that any procedure recommended can be relied upon as the result of personal experience.

The thousands of references to original sources, which enables one to at once put oneself in possession of the complete literature, are of great importance. A full subject and author's index is also of great assistance. The subject matter is arranged in a very clear way, the less important matter being put in small print.

Every recent advance in rhinologic activity is discussed. Considerable space is given to modern methods of diagnosing the source of pus in accessory cavity disease, and the methods by means of suction, which have been so sadly neglected in America, have been given their proper weight.

The introductory chapters on anatomy, physiology and pathology, which were so favorably reviewed in the earlier editions, remain practically unchanged.

All in all, it is an encyclopedia of rhinologic information which will prove a classic for all time to come.

*Horn.*

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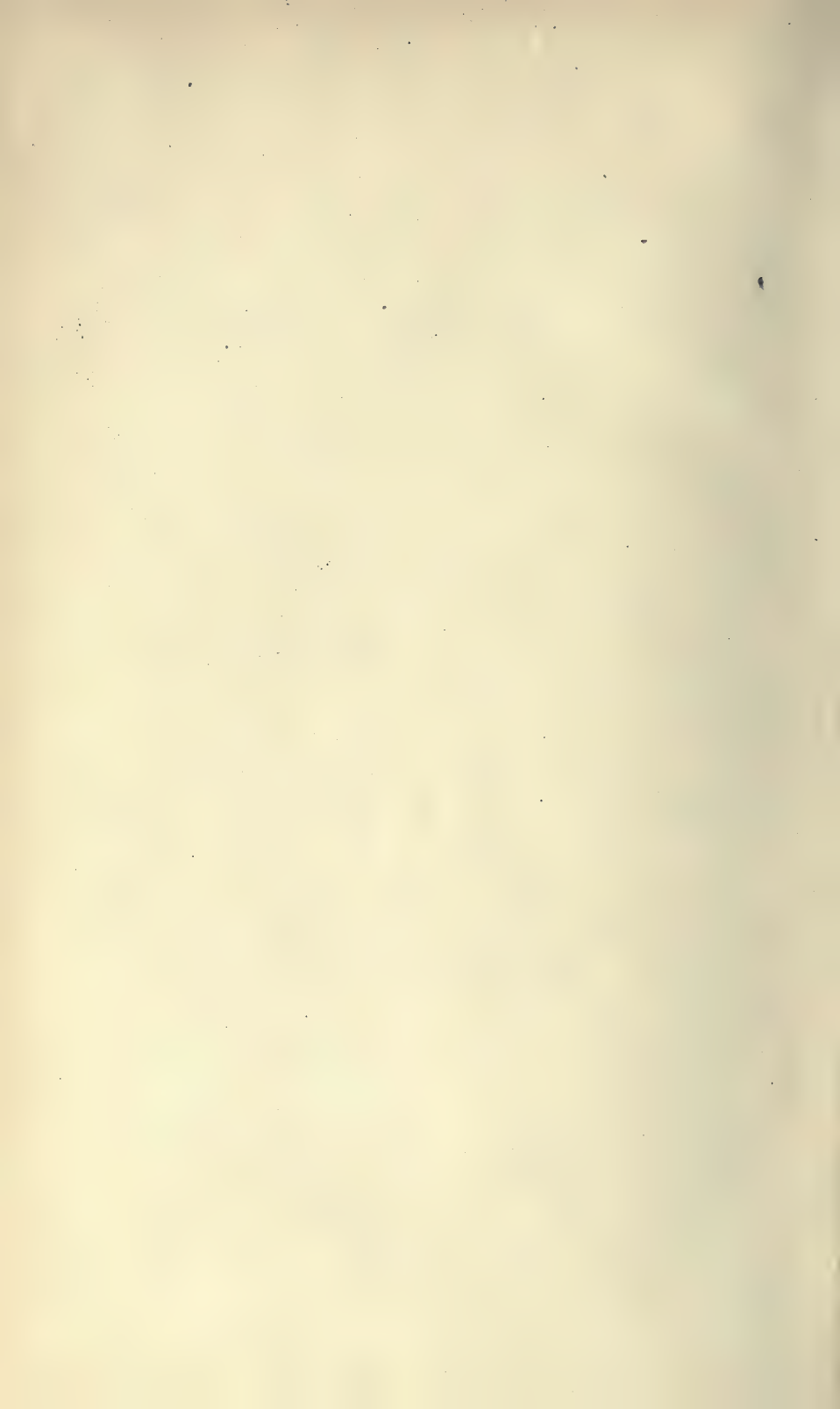
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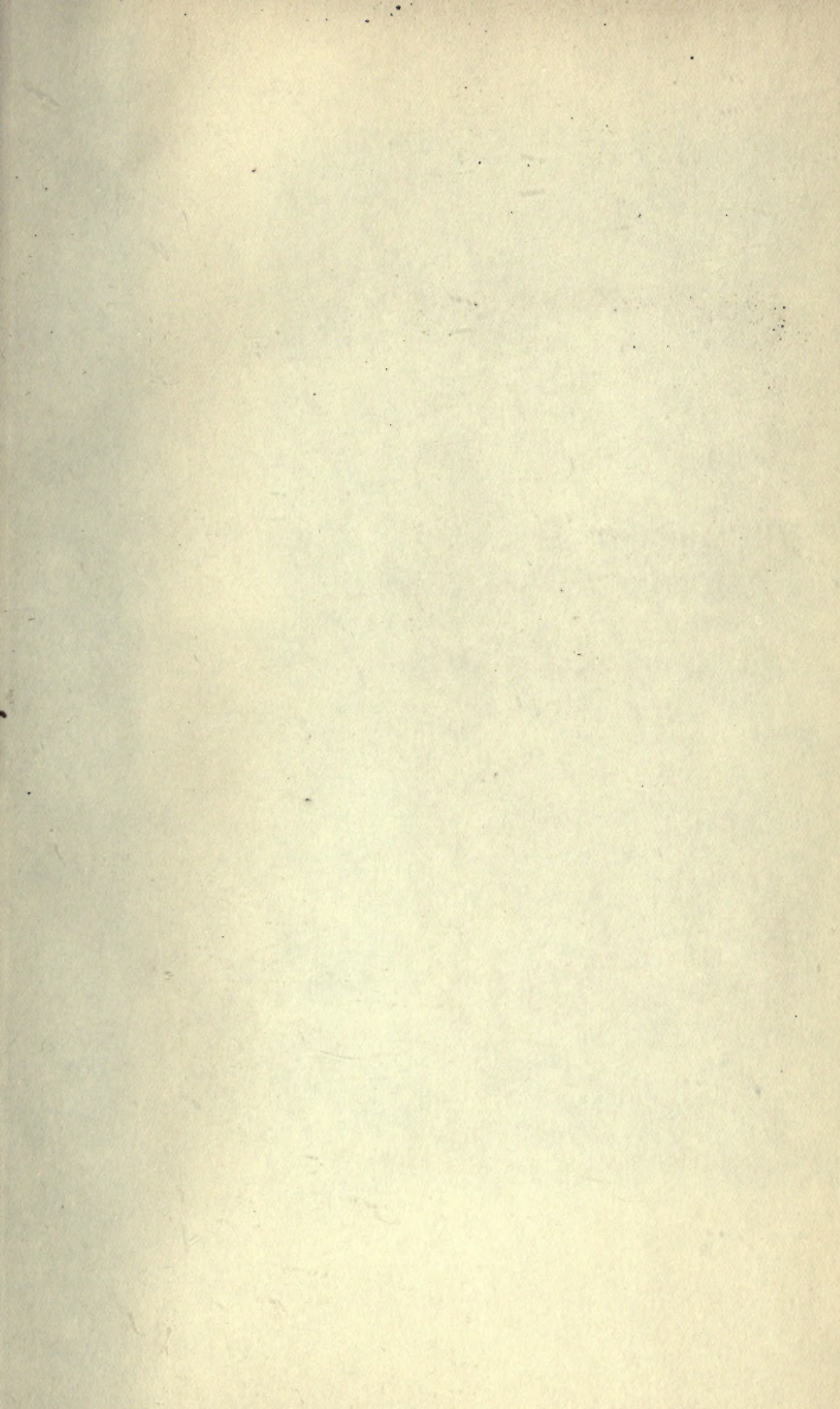
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